Barodynamics is a word destined to become more and more a part of the industry's vocabulary as executives grasp its significance and how it can be applied to many of their problems. So Phil Bucky, pioneer in this field, explains what it means in non-technical language in the first of a new series (p. 40) on model-scale determinations of roof pressures and control. . . . **Mechanical mining** can be just as big a help to a small truck operation as to a large commercial mine. Lone Pine, Utah, where conveyor, cutting machines, electric drills, drop-bottom cars and electrified tipple handle up to 120 tons in two 7-hour shifts, again proves it. This addition to Coal Age's small-mine series will appear next month. . . . **Handling 550 tons** of blocky coal and almost as much slate parting per day with three loading machines is performance in any man's tongue. That is the record hung up at the new No. 2 Borderland mine in Pike County, Kentucky. Face preparation, too, presents its problems. Jack Edwards tells all in the story starting on p. 33. . . . **In less** than a year, Calumet No. 2 mine, in Colorado, has moved to the front rank of efficient thin-

(CONTINUED ON PAGE 7)

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Coal Age

Volume 45 Number 7

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SYDNEY A. HALE, Editor
WALTER M. DAKE, Managing Editor
R. DAWSON HALL IVAN A. GIVEN J. H. EDWARDS
LOUIS C. McCARTHY CHARLES H. LAMBUR, JR. PAUL WOOTON
H. W. CLARKE, Vice-President

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Westinghouse SK Mining Motors

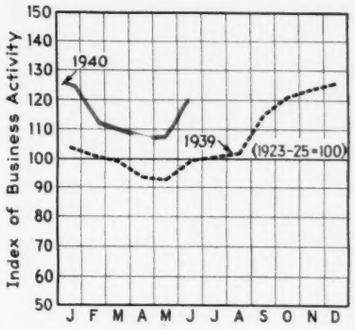
(CONTINUED FROM PAGE 5)

coal conveyor-mining operations. Production, depending on season and development work, ranges from 7 to 10 tons per shift underground in coal averaging 4 ft. thick, with bad roof in spots. The detailed story will be published in an early issue. . . . **Seven**—count 'em—meetings are reported in the news pages this month. To make this possible, Coal Age editors traveled by train, plane, boat and bus to Bluefield, Charleston, Denver, Evansville, Hot Springs, Indianapolis and St. Louis. The roster reads: A.I.M.E. Coal Division, Illinois Mining Institute, Indiana Coal Mining Institute, Mine Inspectors' Institute, Rocky Mountain Coal Mining Institute, Stoker Manufacturers' Association and West Virginia Coal Mining Institute. . . . **Southern Illinois,** with its rich background of mechanical-mining experience, will be featured in Coal Age's Twentieth Annual Model-Mining Number in October. Current and past practices of leading companies will be surveyed. And, because this field has such a history, special emphasis will be given to the part played by management in establishing performance records the envy of many other districts. . . . **The front cover** this month, presenting Chris Shott, general superintendent, Sheridan-Wyoming Coal Co., and new president of the Rocky Mountain Coal Mining Institute, was released for editorial use by the Timken Roller Bearing Co., whose advertisement occupied that spot last July.

HOW'S BUSINESS

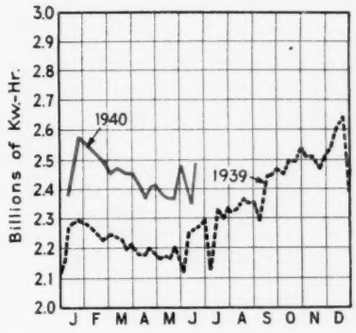
GENERAL BUSINESS CONDITIONS

Accelerated munitions buying by the Allies and expansion of the domestic defense program have brightened the outlook in the heavy goods industries, according to *Business Week*, whose index of business activity reached 119.1 for the week ended June 8, compared with 106.3 four weeks earlier. Consumer goods lagged however, but it was felt that this would not last long. Building contracts in May exceeded those of a year ago for the first time in eight months.



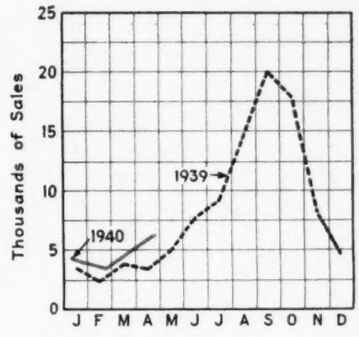
ELECTRICAL POWER OUTPUT

Production of electric energy by the electric-light and power industry during the last five weeks, according to the Edison Electric Institute, was: May 11, 2,386,000,000 kw.-hr.; May 18, 2,422,000,000; May 25, 2,449,000,000; June 1, 2,332,000,000; June 8, 2,452,995,000 kw.-hr. The last three weeks showed gains of 8.7, 10.3 and 11.1 per cent, respectively, over the corresponding weeks of last year, the trend continuing to parallel that of preceding years.



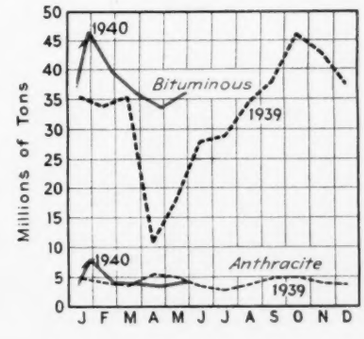
COAL STOKER SALES

Mechanical stoker sales in the United States in April last totaled 6,330 units (U. S. Bureau of the Census from 105 manufacturers), compared with 4,210 in the preceding month and 3,637 in April, 1939. Sales of small units in April last were: Class 1 (under 61 lb. of coal per hour), 5,830 (bituminous, 5,094; anthracite, 736); Class 2 (61-100 lb. per hour), 228 (bituminous, 220; anthracite, 8); Class 3 (101-300 lb. per hour), 147.



COAL PRODUCTION

Bituminous coal production by United States mines in May last (preliminary) totaled 35,468,000 net tons, according to the Bituminous Coal Division, U. S. Department of the Interior, which compares with 32,962,000 tons in the preceding month and 17,927,000 tons in May, 1939. Anthracite tonnage in May last was 3,955,000 (preliminary), according to the U. S. Bureau of Mines, against 3,746,000 tons (revised) in the preceding month and 5,073,000 tons in May, 1939.



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DEVOTED TO THE OPERATING, TECHNICAL AND BUSINESS PROBLEMS OF THE COAL-MINING INDUSTRY

Coal Age

Established 1911 — McGraw-Hill Publishing Co., Inc.

SYDNEY A. HALE, Editor • JULY 1940

Pertinent and Impertinent

• WITH PREPAREDNESS now the National No. 1 Job, it is a good time for every coal producer to check up on his ability to handle his share of the increased load the armament program and shifts in foreign fuel demands will throw upon the industry. Has he made that long-contemplated change from hand to mechanical loading? Are his machines in good shape? Has he enough of the latest, most efficient models? They may not be so easy to get promptly next year.

• AS WE AMBLE to press this bright June day, actual fixing of minimum mine prices on bituminous coal is still just around that movable corner. But why worry? Perhaps by the time the last argument has been heard and the last objection satisfied, the country may be clamoring for maximum prices on solid fuel.

• SALES of Class 1 (residential) stokers the first four months of 1940 increased 40.3 per cent over the corresponding period of last year and were 47.0 per cent greater than in 1938. The total number of units of all classes sold in April—6,330—marked a new high for that month. While the sales volume rolls merrily upward, however, it would be folly to rely too much on momentum; push is still necessary.

• A WAGE-HOUR hearing on redefinition of executives and administrators cites that it shall mean, among other things, one "who has authority to hire and fire, who customarily and regularly exercises discretionary powers, and who does no substantial amount of work of the same nature as that performed by non-exempt employees and who is compensated for his service at not less than $30 for a workweek." A redefinition of "authority," "discretionary," "substantial," "work," "compensated," and "workweek" also might be in order.

• SALT LAKE CITY offers a cheering contrast to the gloomy competitive picture in domestic heating presented by some other areas. City building inspector's records on permits for gas, oil and stoker installations show coal's percentage rising from 48.9 in 1937 to 50.0 for the first five months of the current year. Gas permits in the same period dropped from 51.0 per cent in 1938 to 47.1 per cent; oil permits rose from 0.5 to 2.9 per cent. "The gas blitzkrieg," proclaims *Coal*, that sprightly house organ of Utah Fuel Co., "has stopped, but the propaganda lingers on." So an armistice is hardly in order.

• BLUEPRINTS not backed by matériel and an adequate trained personnel can never win a modern war —unless the enemy is considerate enough to withhold his attack until his opponent is fully prepared. During the past five years Germany has spent the equivalent of $19,100,000,000 for armament; Russia, $13,500,000,000; the United Kingdom, only $6,200,000,000; France, $4,900,000,000, and the United States, $5,100,000,000—the same amount as Japan. In countries with depreciated currencies, these dollar-equivalent expenditures meant still greater purchasing power. That is the compelling reason the United States must now spend faster and more generously than since the preceding World War. The price of peace is preparedness.

• ORGANIZED LABOR, speaking through the C.I.O., is insistent that the national preparedness program to which it pledges its support shall not be used as an excuse for curtailing labor's rights or breaking down existing living standards. Now, if organized labor will give equally strong assurance that it in turn will not use the national emergency to hamper industrial progress by unreasonable demands, everybody will breathe easier.

• STARTED nine years ago with an enrollment of less than 500 students, Penn State's School of Mineral Industries now offers six three-year courses through its extension division. Enrollment this year was nearly 4,000 with 1,934 students registered for the mining curriculum. Who says workers in this industry are not eager to improve their status—within the coal industry itself?

A Common Cause

EVENTS in Europe the past few weeks once again drive home the bitter, age-old truth that unprotected idealism is no match for brute

force. Native courage, however high, barehanded cannot long withstand the crunch of armored tanks and bombs raining from the sky. Neither can a peace-loving nation count too much on the shielding isolation of distance, for inventive genius is annihilating space. Because of these facts, the United States is now launching the greatest peacetime preparedness program in its history.

The need is imperative; the job is the job of no one group. Government, industry and labor all must cooperate sincerely and wholeheartedly so that the task of placing the nation on a war footing superior to that of any other country or combination may be accomplished as speedily as possible. That means organization, which already is under way, and the most effective utilization of the American industrial machine and its resources. It is no fantastic springing of a million men to arms overnight, but a long-pull job of training, coordination and production.

Coal, which is so essential to the manufacture and transportation of so many of the materials entering into an armament program, has lost no time in pledging its full support to this national enterprise. Output of existing mines could easily be stepped up to peak levels. With labor cooperating and no bottlenecks in transportation, no inadequacy in fuel supply should slow up the program to place this country in a position to protect and to preserve the heritage of democracy and freedom it has so long enjoyed.

Clear Track

THERE is no measuring the ingenuity or resourcefulness of a lawyer. To the layman, however, the decision of the Supreme Court in the *Sunshine Anthracite Coal Co.* case would seem to settle all question of the constitutionality of the Bituminous Coal Act of 1937. Every argument raised by the appellant and noted in the majority opinion by Justice Douglas is swept aside; every contention in support of the statute is affirmed. The lone three-line dissent of Justice McReynolds offers nothing upon which to build a rebuttal.

Under these circumstances, it is regrettable that the act expires by limitation next April. That steps to extend or revise the law will be taken before that time is probably a foregone conclusion. But the very necessity for such steps opens the way for a revival of the uncertainty and confusion that have plagued the marketing side of the industry since the Guffey-Vinson measure was enacted. The sooner this uncertainty and confusion can be removed the better it will be for the industry and for the nation.

Healthy Retort

ALMOST from the start of mechanical mining, advocates of more efficient production methods have been "taking it on the chin" from the safety division of the United States Bureau of Mines. No sane proponent of mechanical methods will deny that their adoption introduces new hazards against which proper safeguards must be devised. But to imply that every major disaster which may occur in a mine that happens to be mechanized is due to that mining system is playing loosely with facts. Yet that is the impression many of the utterances of Bureau offices create in the minds of the uninformed.

A recent example of this type of presentation is found in the address prepared by Dan Harrington for the Rocky Mountain Coal Mining Institute. "It is significant," he said, "that all of the five relatively severe explosion disasters of the past three years have taken place in highly mechanized mines." To make the indictment more damning, he added that three of these explosions were on night shifts and four were associated with blasting. Significant of what? Are blasting and night shifts unknown in hand-loading mines? Why assume an intimate relationship between the loading machine and the accident when nothing is offered to justify that assumption?

Fortunately, operators at the Rocky Mountain meeting refused to accept the implied indictment in the usual silence. Wyoming, with its high percentage of mechanical loading, declared one producer, has never had a major disaster in a mechanized mine, but has had two in the past two years in hand-loading operations on Federal lands. If the accident records of mechanized and non-mechanized operations are to be compared, insisted others, accidents attributable to mechanical operation should be segregated from those common to both types of mining.

Such criticism is both fundamental and timely. Half facts are dangerous—especially when twisted to support a thesis. The revolt started in Denver is a healthy one and should be continued whenever and wherever interpretation of safety statistics suggests or implies conclusions for which there are no factual bases. Only in that way can real cooperative progress and understanding be achieved.

Over the Top

LAST MONTH Bituminous Coal Research, Inc., came within striking distance of its modest goal for reestablishing the program suspended some time ago for lack of funds. Subscriptions from a handful of large-tonnage producers' associations would put the campaign over the top. The subscription rate—one-third of a mill per ton—is so insignificant that no association or individual operator genuinely interested in the future of the industry should hesitate longer to sign on the dotted line.

No industry stands in greater need of a continuous research program than coal. Its past record, compared with that of oil and gas, is deplorable. Where those competitors cheerfully spend dollars, many coal men have declined to invest cents. While local agencies may, and probably should, continue to underwrite investigations into local problems, there are so many research problems of wider sectional or national sweep that local agencies are not enough. Only national research under direct industry control will fill the bill.

MOBILE MACHINES

Make Good on Tough Loading Job

At New Borderland Mine in Tug River Field

FROM development at the new No. 2 mine of the Borderland Collieries Co., Pike County, Kentucky, three mobile loading machines are producing 550 tons of coal per day and handle in addition almost an equal tonnage of slate parting. Face preparation is plagued with the problem of bringing the slate down onto the mine floor for machine loading without undue contamination of the lower bench coal. Although not satisfied that the best method has been found, officials of the company have by experiment evolved a method which is superior to the more obvious possibilities first tried.

Borderland mine is wholly in Kentucky but the tipple is across Tug River on the West Virginia side, on the main line of the Norfolk & Western Ry., 6 miles north, or downstream, from Williamson, W. Va. The property was opened originally on an elaborate scale during the early part of the last World War by interests from Roanoke, Va. Still in use at the reinforced-concrete tipple is a Robinson centrifugal tub washer installed in 1918. The large area of Winifrede seam coal in the hills facing the river was worked out, then the less desirable Thacker seam, some 600 ft. lower, was mined until about four years ago. The Leckie interests, whose sales agency, the Leckie Coal Co., Inc., had sold the Borderland coal, became interested in the mine, and now W. S. Leckie, of Columbus, is president.

Four years ago attention was turned to another large tract of the Winifrede seam lying in the hills several miles back from the river. To reach this acreage a 5-mile winding tramroad on a 2½-per-cent grade (3 per cent maximum) was built from the dumphouse to the unmined Winifrede area and steam locomotive haulage installed. No. 1 mine, in a small crop-surrounded section of the area, and which was opened in 1936 with mechanical loaders, was completed last fall.

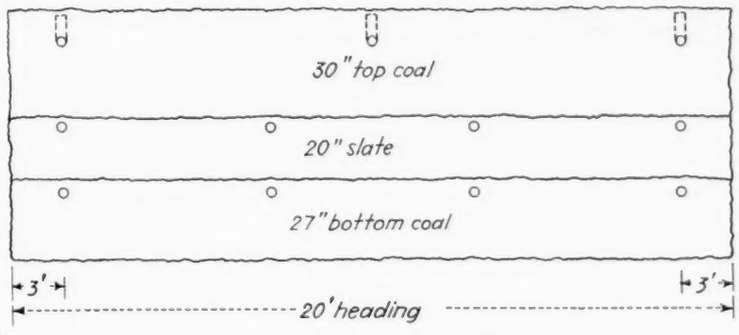
Cutting (Goodman 824 BA slabbers) and loading (Joy 8 BU's) equipment purchased new for that section is now used in the new No. 2 mine, but encounters thinner coal and, in some headings, a thicker slate parting. The average condition in No. 1 was 45 in. of top coal, 24 in. of slate and 45 in. of bottom coal. In No. 2 the averages are: top coal, 30 in.; slate, 20 in.; bottom coal, 27 in.; working height, 6 ft. 5 in. The slate parting, however, is 36 in. thick in some of the headings.

Top is a very strong sandstone and the bottom a firm shale. Two inches from the top of the slate lies a seam of coal 2 in. thick and in some places other thin laminations of coal occur lower in the parting. Work in the new mine, which started Aug. 15, 1939, consists solely of driving main and cross entries each of three headings 20 ft. wide on 60-ft. centers. The coal bed lies fairly flat.

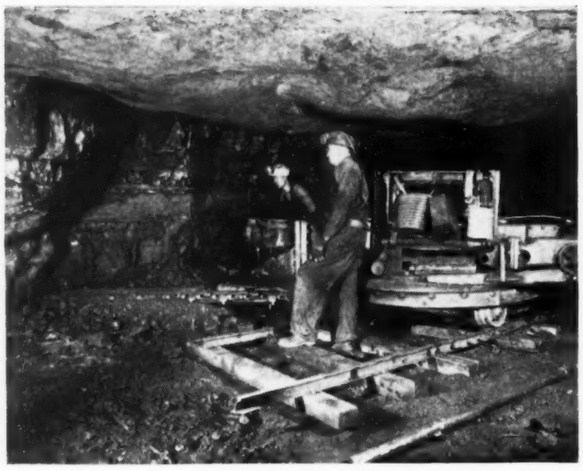
Cutting in the parting and raking the material out with a slabbing machine was tried, but abandoned because of excessive wear on bits and because of excessive wear and tear on the machine itself, inability to get the proper percentage of lump on account of having to shoot the bottom bench so hard, not having sufficient room to rake the refuse out after it was shot up, and the excessive powder cost of shooting both slate and coal. Where it took from ten to twelve sticks in the bottom bench of coal before, now only five are used. The next idea, and one followed for a considerable time, was to cut in the lower bench coal just below the parting, shoot the lower bench with holes placed next to the bottom, and load this coal out before shooting down the parting. Numerous flakes of slate jarred loose from the parting during the cutting, and thus contaminating the bottom coal, was the principal difficulty. Undue breakage of the coal when shot up from the bottom was the second.

Because the mine depends largely on domestic markets a high percentage of lump is important. The coal is of hard, blocky character.

The present system, evolved by changing the cutting from below the parting to the bottom of the bed, re-



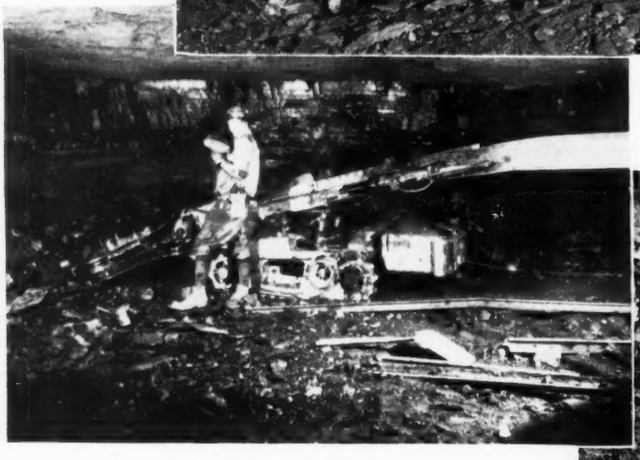
Average section in No. 2 mine and including the shooting plan.



Undercutting gives a better face preparation than cutting at the top of the lower bench.

Digging and loading the blocky coal out from under the parting is a tough job for the machine.

At left, C. J. Kirby, mine foreman, and C. E. Wilburn, superintendent, refer to map in discussing progress.



During loading of the slate parting the helper wields a sledge to break the larger slabs.

The parting is drilled in a 2-in. seam of coal near its top.

sulted in a reduction in slate contamination of the coal to the extent that but two men instead of four are now required for hand picking of the plus 5-in. Explosive charges for breaking down the lower bench are now positioned just below the parting. The jarring of the parting by this position of the explosive would appear to be exactly the wrong treatment, but actually the effect is less detrimental than was the vibration of coal cutting next to the parting.

Coal shooting is done with DuPont Lump Coal C and the slate parting is shot with Monobel B. As indicated by the shooting diagram (Fig. 1), the parting holes are drilled in the 2-in. band of coal which persists near the top of the parting.

When an 8BU loader enters the heading for loading the cuttings and bottom bench it is not moved on to the next place until shooting and loading of the parting and shooting and loading of the top coal have been completed. Usually the loading machine is moved back only 30 to 40 ft. from the face during the shooting. For clearing smoke to hurry the resumption of loading-machine operation intermittent use is made of a Jeffrey blower and 60 ft. of tubing.

Coal and Slate Loaded

Digging and loading the blocky bottom coal from under the parting is a tough job for the loader. That duty together with loading the slate, which includes many large slabs, imposes strains under which the loading machines of ten years ago would not stand for one shift. Breakage of swivel-arm pins after 40 or more shifts is the principal effect of this punishment on the 8BU. A helper breaks many of the slabs of slate with a sledge and the largest chunks that ride over the conveyor of the loader are gobbed along the rib.

In addition to handling the rock, the loaders produce over 100 tons of coal each during many shifts. Where the parting is the thickest the weight of the rock exceeds that of the coal by as much as 10 per cent. Drilling is done with a hand-held Chicago Pneumatic unit using twist augers with plain forged points. The cutting machine has a 10-ft. bar and uses standard bits. Each loader is serviced by a cable-reel locomotive. Two of these are Goodman and the other is an 8-ton Jeffrey.

To avoid some of the track-extension expense and to learn if a square face will afford better shooting than a curved face, a Goodman 12AA shortwall machine fitted with Bowdil chain and bits is being given a trial. Preliminary observations indicate that shortwalls will take over all of the cutting.

The mine works two shifts and lighting equipment consists of 80 Edison Type K lamps. Direct-current power at 275 volts for inside operations is supplied from a 200-kw. synchronous converter with automatic reclosing d.c. breaker and manual starting controls.

Last September, 60 new A.C.&F. stub-axle Timken-bearing steel cars were purchased to supplement 50 wooden cars that are continued in use. Track gage is 48 in. and the wheelbase of the new steel cars is 38½ in. Machine loaded, these new cars average 3½ tons of coal. They stand 26 in. above the rail, are equipped with spring bumper and buffer at one end and are without brakes.

A 21-ton Vulcan rod locomotive and a 28-ton Shay geared locomotive handle the mine cars over the 5-mile outside haul. A normal trip consists of 40 cars and on the loaded downgrade haul seven single-wheel skids are applied to a trip.

Operation of the mine is in charge of C. C. Wilburn, superintendent, and C. J. Kirby, mine foreman. W. W. Coleman, of Aflex, Ky., is chief engineer and L. W. Helmintoller, of Bluefield, W. Va., general superintendent.

From headhouse in Kentucky to the tipple in West Virginia the Borderland coal is carried over Tug River on a long apron conveyor.

Approaching the dump are two of the 60 new steel cars, 26 in. high and carrying 3½ tons mechanically loaded.

[SECOND OF TWO ARTICLES ON THE NEW CASTLE GATE PREPARATION PLANT]

NEW UTAH FUEL PLANT

Supplements Washing of 3x0 Coal With Drying Equipment and Fine-Coal Blending

To prepare 3x0-in. Castle Gate and Clear Creek coal for market, the new Castle Gate preparation plant of the Utah Fuel Co. employs an air-pulsated wash box, shaker and vibrating screens, a centrifugal dryer, screen and rotary heat dryers, and auxiliary crushing equipment for adding to the output of small coal when desired. Storage bins with proportioning feeders are employed for making "prescription-mixed" small sizes and stoker.

By CARL S. WESTERBERG
Preparation Engineer, Utah Fuel Co.

And IVAN A. GIVEN
Associate Editor, Coal Age

DESIGNED to wash, size, dry, blend and dustproof the product of two different mines with varying characteristics, the new 250-tons-per-hour central preparation plant of the Utah Fuel Co., Castle Gate, Utah, as detailed in the first article of this series (June *Coal Age*, p. 41) now prepares 3x0-in. coal from both the Castle Gate and Clear Creek mines for market. Results, as set forth in the previous article, have included a substantial reduction in impurity content and marked improvements in other factors affecting combustion results, including a high degree of uniformity in quality, moisture content and size make-up secured by washing, heat and centrifugal drying, screening and blending in a special plant.

As Clear Creek mine is some 35 miles by rail from Castle Gate, where the new plant has been built adjacent to the existing Castle Gate tipple, Clear Creek 3x0-in. coal is shipped in to the Castle Gate storage yard under a processing-in-transit arrangement with the Denver & Rio Grande Western R.R. From the storage yard, loaded cars are shuttled to a reinforced-concrete "pit" built under the "dust" track above the original tipple. This pit also is useful in rerunning storage coal and on any other occasion when it is necessary to retreat or rehandle coal under 3 in. The pit also acts as a surge bin for the mechanical-cleaning plant, and as such receives 3x0-in. coal from the main screen in the Castle Gate tipple. Capacity of the pit, when receiving railroad coal, is 250 tons; when receiving tipple coal the capacity is reduced because filling is done from one point only.

Castle Gate coal, after being dumped from mine cars, is conveyed up to the main screens in the original Allen & Garcia tipple. These screens separate the feed into 8-in. lump and 8x3-in. stove, plus a 3x0-in. resultant which is chuted to a 42-in. belt conveyor leading to a ladder chute feeding the coal down into the pit. Lump and stove are picked on shaking picking tables, illuminated by Westinghouse mercury-vapor lights, and then go to their respective loading booms or box-car loaders. A cross conveyor permits mixing the two sizes when desired.

Picking at Castle Gate is arranged to yield pure refuse, run direct to the refuse bin, and bony, which is crushed and sent to the washing plant. Crushing facilities also include breakers for reducing lump and stove, after picking, to minus 3-in. The crushed coal is recirculated to the main screen to take out oversize, the remainder going to the pit with the natural 3x0-in. Thus, it is possible to supplement the natural product with crushed lump or stove, or both, up to the capacity of the wash box—250 tons per hour.

A 48-in. reciprocating feeder under the pit hopper moves the coal out onto a 42-in. belt conveyor (18-deg. pitch, 216-ft. horizontal centers) leading up to the feed sluice to the wash box in the new plant. A channel iron gate may be raised or lowered to adjust the rate of feed out of the hopper.

Cleaning is done in a Link-Belt 5044 five-cell two-compartment air-pulsated wash box with improved electric-eye reject control and screen chip arrestor, supplied with air by a Roots-Connersville blower. Primary refuse falls directly into a 50-ton steel bin with undercut gate for loading trucks. Drainage facilities in the bottom of the bin conduct water to floor drains leading to a sump for eventual return to the washing system. This is one of the several measures taken at the plant to save water. Secondary refuse is discharged to a chain conveyor which elevates it to a 1-in. grizzly screen.

Oversize goes to the refuse bin, while the undersize flows by water to the top deck of a high-speed refuse- and slurry-dewatering shaker. Minus $\frac{3}{8}$-in. material through the top deck falls onto $\frac{1}{2}$-mm. wedge wire on the bottom deck for final dewatering. This bottom deck, as will be explained later, also receives slurry from the

secondary settling cone for dewatering; the water, carrying nominally minus 28-mesh material, being returned to the washing system. In this way, water is conserved and the possibility of stream pollution is eliminated. To dispose of refuse, two 10-ton International end-dump trucks have been purchased, for haulage, and a Caterpillar diesel tractor with La-Plant-Choate bulldozer for spreading the refuse on the bank.

Clean coal leaving the washer flows with the water to a fixed sieve for unloading water and fines to the lower shaker and then onto two flexible-hanger classifying screens set on a 5-deg. slope and operating at 150 6-in. strokes per minute. The upper shaker, 7½ ft. wide and 25½ ft. long, comprises two decks, the top fitted with about 112 sq.ft. of 1⅝-in. round-hole plate and the bottom with about 126 sq.ft. of 1-in. perforated plate. The 3x1⅝-in. nut and 1⅝x1-in. pea made on this screen flow off the end into cross conveyors.

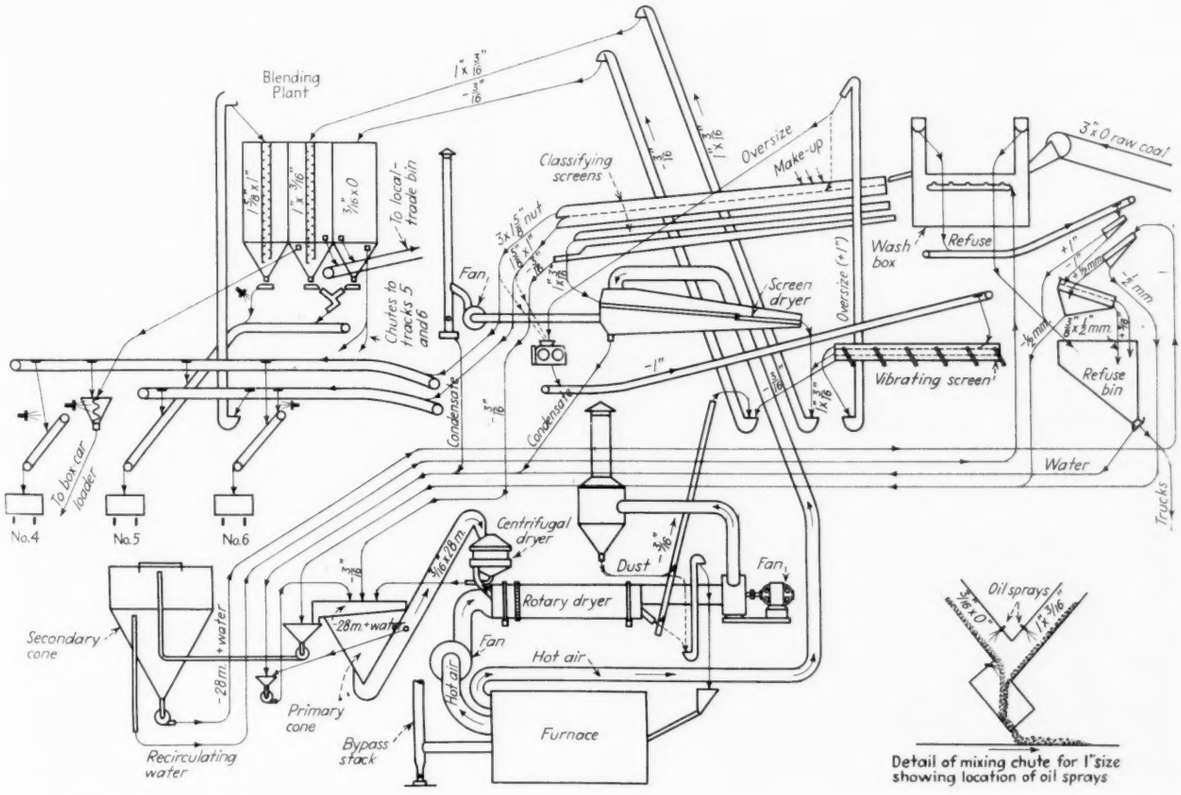
The nut conveyor can discharge this size onto any of the three apron-type loading booms provided, all equipped with 5-ton Shaw-Box "Load-Lifter" hoists, or into a small car-changing bin equipped with a spiral lowering chute which feeds a box-car loader. The 1⅝x1-in. pea usually also is loaded on one of two tracks but can be carried by elevator to one of the three 125-ton blending bins equipped with a lowering ladder to reduce degradation.

Either the nut or pea, or both, however, may be diverted to a 36x60-in. Type C two-roll adjustable chain-driven Link-Belt crusher with a maximum capacity of 125 tons per hour. The crusher product, nominally minus 1-in., is conveyed to a 4x12-ft. double-deck Symons horizontal screen which separates in into plus 1-, 1x$\frac{3}{16}$- and minus $\frac{3}{16}$-in. sizes. The last two go to the elevators feeding the respective bins in the blending plant, while the oversize (plus 1-in.) is returned to the crusher, although it may be discharged onto the classifying screens.

Minus 1-in. coal through the bottom deck of the upper classifying screen falls onto the lower shaker (one deck), where it is separated into 1x$\frac{3}{16}$- and minus $\frac{3}{16}$-in. sizes preparatory to dewatering. In the case of the 1x$\frac{3}{16}$-in. size, this dewatering is done on a Link-Belt screen-type heat dryer comprising two flexible-hanger screens operating at 170 4-in. strokes per minute, plus the necessary hoods, exhauster and other auxiliaries. Both screens, fitted with $\frac{3}{16}$-in. round-hole plates, are 6 ft. wide, with the upper one 28 ft. long and the lower 13 ft. long. Drying air at about 550 deg. F. is pulled down through the coal by a Clarage Size 41 exhauster rated at 39,000 c.f.m., 100-deg. F. air, 3-in. static pressure. The screen dryer reduces surface moisture of the 1x$\frac{3}{16}$-in. size about 3 per cent or more, as required. From the dryer the coal is conveyed to the elevator feeding the proper bin in the blending plant—also equipped with a lowering ladder to reduce degradation.

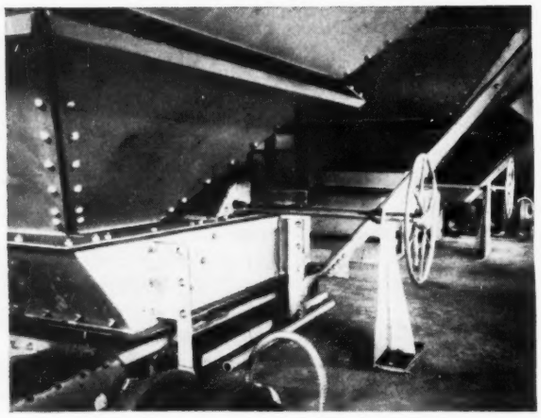
Minus $\frac{3}{16}$-in. coal through the lower classifying screen also is put through a drying process which involves: first, removing minus 28-mesh fines by hydraulic separation; second, centrifuging the $\frac{3}{16}$-in. x 28-mesh size; and, third, finishing the job by heat-drying. In this flow system, the minus $\frac{3}{16}$-in. coal and water fall through the screen into a collecting pan and are sluiced to a primary settling cone which also acts as a classifier—the overflow carrying out the minus 28-mesh fines. This primary cone (see flowsheet) also receives the centrifugal dryer effluent and water from various drains.

Water and minus 28-mesh overflowing the primary cone pass to a sump, from which they are relayed by a 3,500-g.p.m. American Well Works centrifugal pump to a secondary settling cone. Clarified water from

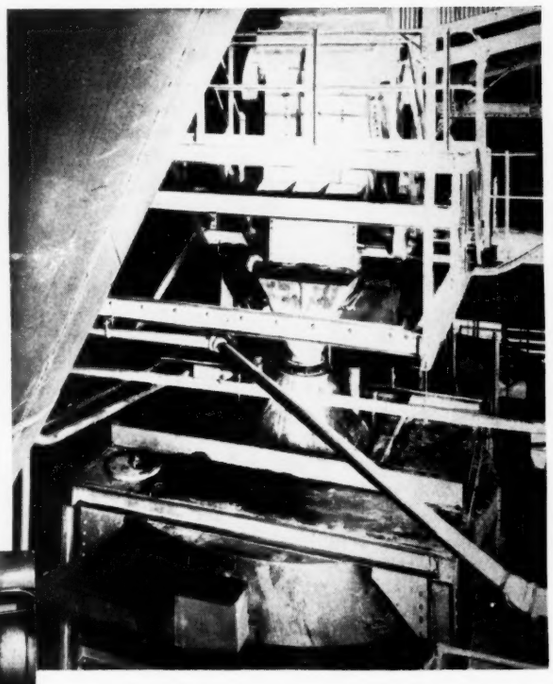


Flow diagram for Castle Gate washing, screening, drying and blending plant.

Detail of mixing chute for 1"size showing location of oil sprays

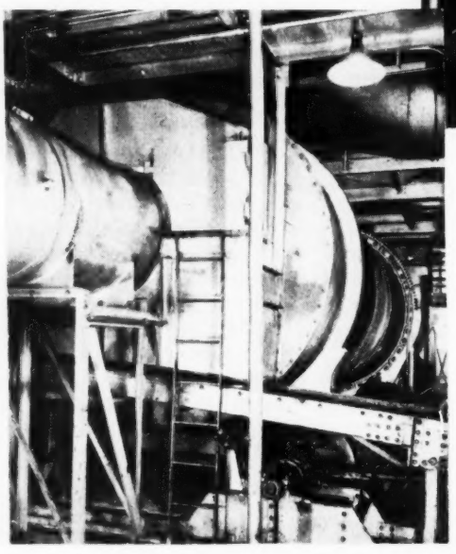


Underneath the storage bins in the Castle Gate fine-coal blending plant. The proportions of the various sizes in a mixture are determined by adjustable gates and adjustable-eccentric feeders with variable-speed drives.

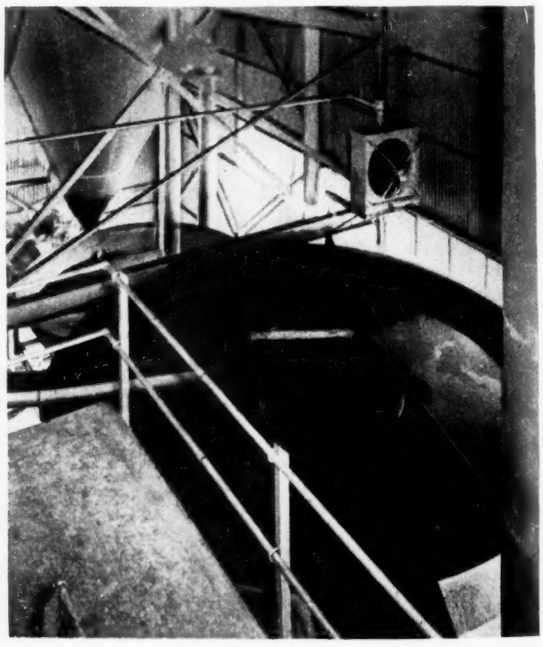


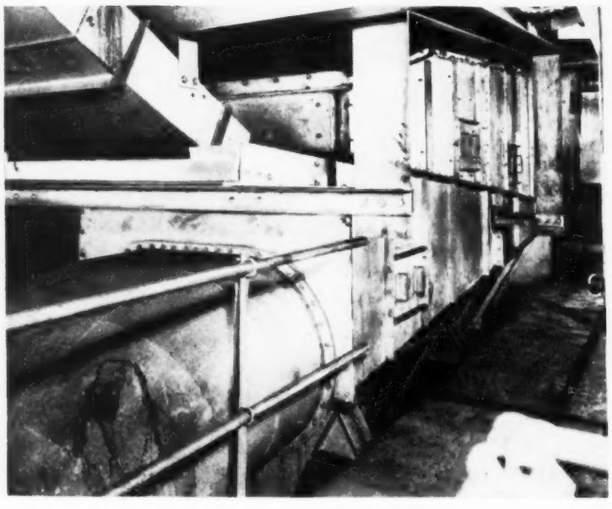
A continuous centrifugal dryer accomplishes the first stage in the dewatering of 3/16-in. x 28-mesh coal at Castle Gate. It is fed by an elevator from the primary cone.

Minus 3/16-in. coal is run to this primary settling cone for separation of minus 28-mesh fines, which overflow into a sump and are pumped to the final cone shown in background.



Final dewatering of 3/16-in. x 28-mesh coal is done in this rotary heat dryer.





This screen-type heat dryer removes water from the 1x3/16-in. size.

this cone flows by gravity back to the wash box. Slurry taken out of the bottom of the cone is pumped (A.W.W. 250-g.p.m. centrifugal) to a stationary slurry-dewatering screen fitted with ½-mm. wedge wire. Water and fines through the sieves are returned to the secondary cone, while that passing over the sieves is delivered to the bottom deck of the refuse-dewatering screen for final moisture extraction and discharge to the refuse bin. While this material contains some plus 28-mesh size, it carries mostly undersize slurry, which helps to keep the circulating load from building up in the wash water.

Castle Gate town water is used for make-up, coming in by gravity from a mountainside storage tank to sprays on the classifying screens. The make-up water is first used to cool the bearings on the "Roto-Louvre" hot-gas fan. Total make-up water averages about 125 g.p.m.

Rotary Distribution Used

Coal settling to the bottom of the primary cone (⅜-in. x 28-mesh) is removed by a Luhrig dewatering elevator. This elevator discharges the coal over a rotary distributor—to even out the flow—into a 48-in. Elmore continuous centrifugal dryer with a capacity of 50 tons per hour. Surface moisture of the coal entering the dryer ranges from 26 to 34 per cent; leaving the dryer, 6 to 7 per cent.

From the centrifuge, the ⅜-in. x 28-mesh coal drops into a No. 1003-30 Link-Belt "Roto-Louvre" dryer supplied with 775- to 780-deg. F. hot gases by a Clarage Size 53 blower rated at 47,300 c.f.m., 700-deg. air, 7½-in. static pressure. Temperature of the air leaving the dryer is around 140 deg., and is handled by a Size 41 Clarage exhauster rated at 29,000 c.f.m., 175-deg. air, 4-in. static pressure. The exhauster discharges to a 144-in.-diameter cyclone separator, which recovers any fine coal in the exhaust gases (about 84 per cent 100-mesh or finer), which normally is used as stoker fuel or may be returned to the dried ⅜-in. x 28-mesh product. A shaking chute carries the dried coal to the elevator feeding the ⅜-in. x 28-mesh bin. A flop gate also permits diverting the dried product into an elevator feeding the storage bin for the dryer furnace.

Hot gases for both the screen and "Roto-Louvre" dryers are supplied by an Economy Furnace Co. suspended-arch-type furnace fired by a three-unit "Firite" spreader stoker. The stoker bin is equipped with a high-level "Bindicator" to show when it is filled. The furnace is designed to heat 60-deg. F. air to 700 deg. or more, depending upon the firing rate and tempering practice, and deliver 107,200 c.f.m. at 700 deg. with a heat release of 45,000,000 B.t.u. per cubic foot per hour. Combustion air is supplied by a Clarage forced-draft blower. Tempering air may be admitted to the furnace itself, with additional dampered inlets in the dryer ducts for supplementary tempering as required. Automatic controls are provided for closing the ducts, bypassing the gases to the atmosphere and shutting down the stoker in case of dryer stoppage.

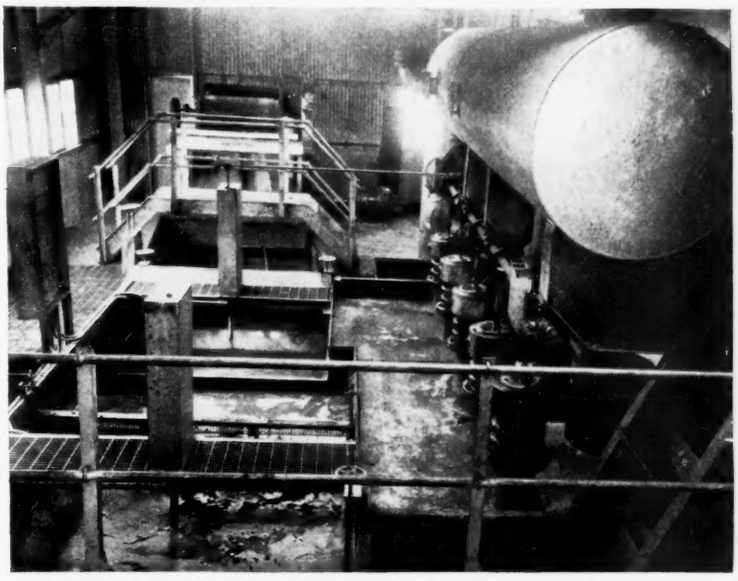
The blending plant at Castle Gate, installed for making "prescription" mixtures of the smaller washed sizes, particularly stoker, includes, as noted, three 125-ton bins for the 1⅝x1-, 1x⅜- and ⅜-in.x28-mesh sizes. Two of the bins are equipped with ladder chutes to reduce degradation and all three are fitted with high- and low-level "Bindicators." Auxiliary gates and chutes in the 1x⅜-in. bin permit running this size either to the nut surge bin, from which it is chuted to the box-car loader (Manierre) or to a belt conveyor to a local trade bin.

The ⅜-in.x28-mesh bin also is equipped with two auxiliary gates and chutes, one of which permits running this size to the belt feeding the local trade bin and the other to either of two tracks for direct loading without operating the regular feeding and boom equipment.

Blending of the three sizes stored in the bins is done by means of adjustable gates and variable-speed feeders. Under each bin is a reciprocating feeder with adjustable eccentric driven through a Link-Belt "P.I.V."-gear variable-speed transmission. Each feeder is 36 in. wide and 5 ft. 8 in. long. Attached to the bin frame above each feeder is a rack-and-pinion gate for controlling the depth of the coal on the feeder plate. By these means, the feeding rate, and consequently the percentage, of any particular size in a mixture may be adjusted to very close limits. From the feeders, the various sizes, or any one size, fall onto an apron conveyor terminating in a loading boom.

All sizes made in the new Castle Gate mechanical-preparation plant may be dustproofed with 700-second oil, using Viking dual heating equipment, nozzles and meters. Points at which the oil is applied are indicated in the accompanying flowsheet, which also indicates the nozzle arrangement in the special mixing chute following the feeders for the 1x⅜-in. and ⅜-in.x 28-mesh sizes.

With a steel frame, concrete ground floor and foundation, 22-gage corrugated galvanized roofing and 24-gage siding, some 200 sq.ft. of wire-glass skylights, steel-sash windows and standard steel doors, the new Castle Gate plant also includes 4-in. reinforced-concrete floors, 3-in. reinforced-concrete conveyor walkways, Blaw-Knox "Electroforged"-grating stair treads and two-member guard rails



Washing is done in this air-pulsated wash box with "electric-eye" control. In the rear is the discharge of the main raw-coal conveyor.

where required. The design provides a high degree of accessibility for repairs or replacement of equipment, as well as ample height and width in all passages used by men.

The plant, exclusive of unit heaters and certain other auxiliary equipment, is driven by 44 Westinghouse Type CS "Sealed-Sleeve" squirrel-cage motors totaling 797 h.p. With unit-heater and other special motors, the total horsepower is 805. Splashproof motors are used for driving the classifying screens, heat-drying screens, Symons screen and pumps. Except for an automatic compensating starter for the hot-gas blower motor, Westinghouse "De-ion"-type magnetic linestarters operated by pushbuttons are used throughout. All starters are grouped on one central panel, with the pushbuttons on three-console type panels —the main one at the wash box and the auxiliaries in the car-loading bay and at the dryer furnace.

Controls are arranged for full-automatic starting in sequence, if desired, but as a practical matter each motor is started individually in proper order, as it has been found that as the operators have become experienced they can accomplish proper starting and at the same time leave out unneeded units—an impossible procedure with full-automatic sequence starting. All electrical work was done by the Post Electric Co., and includes, among other things, rigid conduit for both the 440-volt power and 110-volt lighting circuits, with flexible conduit for motor connections.

Drives include some Goodyear V-belts, but the most-used type is made up of a combination of Link-Belt "Silverlink" roller chain, a single- or double-reduction Link-Belt herringbone speed reducer (a few other types are employed in special cases) and a Link-Belt "RCB" flexible coupling. Guards for moving parts or equipment include oil-tight casings for the roller chains and oil-retaining inclosures for the flexible couplings. Copper-bearing steel is used in all chutes and sluices, as well as in the dryer ducts, etc. Belt conveyors (Goodyear "National"-brand belts) are equipped with Link-Belt roller-bearing idlers with Alemite fittings. Alemite fittings also are installed in the grease caps on all other bearings, with flexible-hose extensions on bearings on shaking screens and chutes.

Nine "Venturafin" unit heaters are installed to keep the plant warm in cold weather, and are supplied with steam by a new Murray water-tube boiler fired with washed coal brought in from the local-trade bin by a screw conveyor. The firing unit is an Iron Fireman "Poweram" Stoker. An old fire-tube boiler has been reconditioned as a standby. Operation of the new preparation plant is under the supervision of W. D. Bryson, general superintendent, and William Moorhead, mine superintendent, with Earl Warren as master mechanic and Charles Houghton as plant foreman. Utah Fuel Chief Engineer F. Nyman and the preparation engineer cooperated with Link-Belt engineers in perfecting the design of the plant and now keep check on its performance.

HOW BARODYNAMICS

Knocks "Guess" Out of Roof Control

By Using Small-Scale Models of Mine Strata

By PHILIP B. BUCKY
Associate Professor of Mining
School of Mines, Columbia University

BARODYNAMICS probably may best be explained by stating that its object is to provide a sound basis for solving structural problems dealing with the underground, the surface, and the geological material in between. For example, what span shall the room or stope have? What dimensions and shape shall the pillars have? What timber dimensions, structure and spacing are most economical? What length of face shall be used in longwall? To this list may be added many others with the reasonable assurance that these problems may now be investigated and answered in a manner other than by cut-and-try methods in the field or directly following the practice of a neighboring operation.

To understand the procedure involved in barodynamic methods, the reader need worry little about his mathematics. While he may have assumed that somebody knew enough mathematics and physics to solve all these problems, and while his superior may still think he can solve them, let them both be assured that from a purely mathematical standpoint nobody can.

Hydraulic engineers probably were the first to realize that mathematics and theory alone were insufficient to solve their problems. They early saw the necessity for models and it is from them we learned that small-scale models might give results which could be translated to full-scale operations. Naval engineers followed suit, with models of ships in tanks. The design of the "Queen Mary" and the last Ameri-

ca's Cup defender were based on tests of model ships in tanks, and the defender's results, over its English competitor, not designed on the basis of such tests, are well known. People interested in airplanes made use of model planes in wind tunnels, and the improvement in flying in the last decade is directly traceable to these tests. In regular wind-tunnel testing, instruments are connected to the model so that various measurements may be taken, from which calculations are made as to what the prototype, or full-scale machine, will do.

Use of models to solve mining problems was suggested and tried many times. The difficulty with making these experiments of value from a scientific point of view was the variety of material to be considered—limestone, sandstone, clay, etc. Hydraulic, aeronautic and naval engineers had only a few factors to consider, which in turn could be limited to one for experimental purposes.

Using the Model System

We were up against it, therefore, until about ten years ago, when the following law or principle of similitude was established: "That a model built to scale of the same material as the prototype (full-scale structure) will behave like its prototype within and beyond the elastic limits of stress if the model weight is increased in the same proportion as its size is decreased. The controlled effect of an increase in weight is obtained by rotating the model in a centrifuge and varying its speed."

This means that if the geologic structure is known, a model of it may be made to any scale—say 1 to 1,000—and rotated at a speed which may be calculated so that the centrifugal force is equal to 1,000 times gravity. While rotating at that speed the model will behave like the full-scale structure.

The law looks—and is—simple, but making it work was a trying though pleasant occupation. A centrifuge had to be built, speed measurement, and recording and balancing devices developed, and a means for observing and recording the behavior of the model while rotating found. Everything except Edgerton's stroboscopic light was developed in the laboratory. Equipment also was developed to measure roof sag and bottom heave while rotating, and to make photographic records including moving pictures.

Doubtless the reader recalls that at one time he could determine the stresses in all parts of a fixed, simple, cantilever beam, or column, with special types of loading. What is more difficult to remember is that the theory and mathematics used applied only if the material was isotropic (had similar physical properties in all directions) and was stressed within the elastic limits. He was not shown how to determine the stresses in beams with partial restraint on a yielding support as mine roofs over pillars, nor in roofs and pillars stressed beyond the elastic limits, nor in mine tunnels, drifts or gangways; nor in a bottom under a pillar. Suffice it to say that many (not all) of these problems may now be solved, but most of them require not only mathematics but a model as well.

Explaining barodynamics to men who have not kept up with the rapid advances in the science of physics is not easy. Textbooks of ten years ago are out of date because of the many new concepts introduced since that time. Unless the student of 1930 has kept up with these changes, he finds difficulty not only in understanding the subject but also the young engineer who comes to work for him. This article in non-technical language, however, clears away the fog.

The process for development of the model solution procedure was as follows: Since the theory of the behavior of simple units made of perfect materials, stressed within the elastic limits (for example, a cantilever or simple beam) is known, the conditions may be determined under which a scale model will behave like its prototype. For example, in models of the same material, bending or strain at similar points must be proportional, and the unit stresses at similar points must be the same. Then if the model behaves like the prototype within the elastic limits of stress, it may be reasoned that it will behave like the prototype beyond these limits of stress: i.e., within the plastic and through the rupture changes. Furthermore, if a model of elastic material behaves like its prototype, a model of a plastic material will do likewise. In addition, since the behavior of the model depends upon the manner of applying the load, the load on the model must be applied similarly to that on the prototype. A theoretical analysis will show that the law stated meets these conditions. It thus becomes obvious that a model will bend and break like its prototype and the time of break in the model will be proportional to that in the field.

Avoiding Trial and Error

This means that model experiments may be run to give information as to how a roof will break, whether an ore will block cave, and how long it will take a roof to fail or block of ore to cave, besides other problems too numerous to mention. In addition it provides a means of subjecting ideas in mining to test without a large expenditure of time and money or at great bodily risk.

First experiments were done with a hand centrifuge, shown in Fig. 1, before a meeting of the American Institute of Mining and Metallurgical Engineers and described in detail in T.P. 425. The material was a plastic clay roof on wooden supports, a combina-

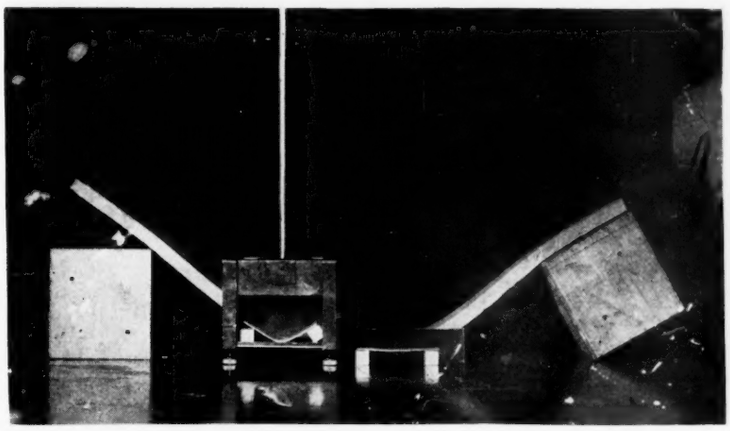


Fig. 1—Similarity in bending under equivalent stresses: both model and structure made of plastic clay; model left standing bent only slightly.

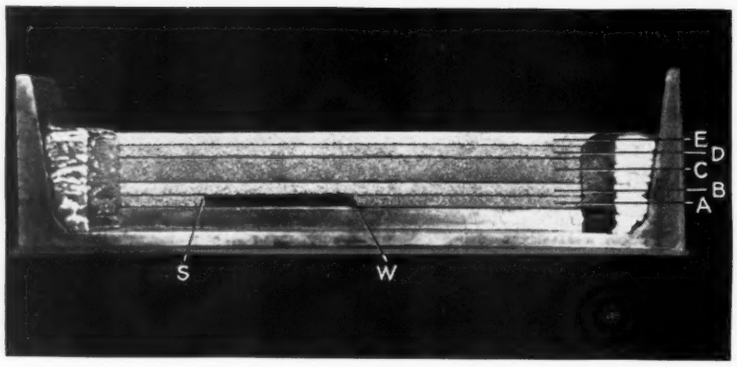


Fig. 2—Model in holder before test. *A*—orebody, 3/16 in. constant; *B*—immediate roof, 3/16 to 1/8 in.; *C*—bed, 3/8 in. constant; *D*—bed, 3/16 in. constant; *E*—bed, 3/16 in. constant; *S*—stationary face; *W*—working face.

tion difficult to handle from the theoretical and mathematical standpoints. The model (scale 1/8) under the action of gravitational forces behaved unlike the prototype, but a similar model rotated by hand behaved exactly like the prototype. A more ambitious and expensive test was then tried; a concrete beam 90 x 20 x 10 in. was then poured and from this same material small blocks (scale 1/10), 9 x 2 x 1 in., were cut. The centrifuge had an 8¼-in. radius and the r.p.m. at which the small blocks were to be rotated was calculated at 209. Support was removed from the large block and it failed. The models were then placed in the centrifuge, run at the calculated speed and failed similarly. On careful measuring of the distances between cracks it was found that the results checked within 4 per cent.

The procedure in barodynamic testing is as follows:

1. Make a study of the geologic structure.
2. From the problem in hand and centrifuge available determine the model scale or model ratio (assumed here as 1,268, and r.p.m at which it will run 2,350).
3. Calculate the data in Table I: i.e., the model dimensions are the prototype dimensions ÷ model ratio (1268).
4. Construct model and place in holder as in Fig. 2.
5. Balance counterweight in balancing device, for balanced running in centrifuge.
6. Place in centrifuge and bring up to speed.
7. Observe and photograph.

The results of the test are shown in Figs. 3 and 4.

Table I—Model and Prototype Dimensions

Model Ratio, M.R. 1268

Location	Model, In.	Prototype, Ft.
Bed E, surface layer	3/16	19.8
Bed D	3/16	19.8
Bed C	3/8	39.6
Total overburden on roof B	....	79.2
Bed B, immediate roof	3/16	19.8
Total cover	....	99.0
Bed A, vein being worked	3/16	19.8
Total working face retreat	2.25	238
	2.50	264
	2.75	290
	3.00	317
	3.25	343
	3.50	370
	3.75	396
	4.00	423
	4.25	449
	4.50	475

These data, taken from T.P.'s 946 and 1020, show what takes place in longwall mining, a method used for mining iron, coal and gold under certain conditions, but referred to by other names, depending on the material mined. The vein was mined back a given amount and then replaced in the centrifuge and run at 2350 r.p.m. The effect all through the geologic structure may be noted with each face retreat, and the model at the completion of the test is shown in Fig. 4. All dimensions shown in the figure are obtained by multiplying the model dimensions by the model ratio (1268).

It may not be amiss at this point to state that a simple model using vein *A* and roof *B* alone might have been used to determine a safe span or time effects for room and pillar mining. Complicated geological structures can, in general, be reduced to parts which may be solved with the aid of simple models.

Reaction of many men in the field to this type of research and investigation probably is best stated by Carl A. Peterson, Hudson Coal Co., who also provides the answer in his discussion of T.P. 1020, "Effects of Artificial Support in Longwall Mining as Determined by Barodynamic Experiment," and T.P. 1140, "Photo-elasticity and its Application to Mine Pillar and Tunnel Problems" (the author has taken the liberty of making minor changes in Mr. Peterson's text):

"The first reaction of many mining men to barodynamics has no doubt been that the method will probably work very well for the simple and uniform set of condi-

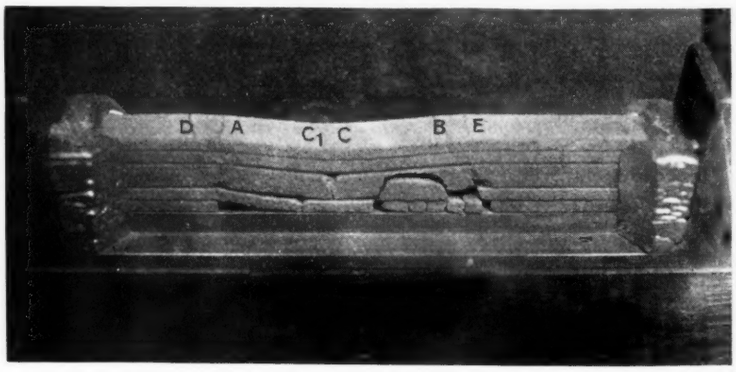


Fig. 3—Model after longwall test showing complete breakdown of strata from mined seam to surface. *DAC*$_1$, *B* and *E* are positions of surface cracks. For details of progressive breakdown, see Fig. 4, p. 43.

tions assumed for the laboratory experiments but will fail to yield information of value when applied to the variable and complicated conditions found in the field. That might have been my reaction also if I had not been fortunate enough to have had some field experience which closely agreed with the laboratory findings. At the time I read his paper on longwall mining, a couple of years ago, I had just completed the daily supervision of a considerable amount of longwall mining covering a period of three and one-half years and involving more than 6,000 ft. of longwall retreat and the extraction of about 300,000 tons of anthracite coal. For roof support steel props were used, which allowed the strata over the mined out area to fall without hindrance, in this respect resembling the condition assumed in the laboratory experiments. Study of the experimental findings enlightened me as to the significance of some of the phenomena I had observed in the field. This was true even though the conditions in the field were apparently much more complicated and variable than the conditions assumed for the laboratory experiments. I therefore have a strongly grounded belief in the possibility of using barodynamics to aid in solving certain mining problems.

"I would like to compare briefly at this time my observations of longwall work in the field with Prof. Bucky's laboratory findings.

Experience Checks Tests

"1. He concluded that the minimum length of longwall face should be preferably at least five times, and in no case less than 1½ times, the span at which the overweight will fail as a beam. I am not able to say at what length of span the overweight failed in the longwall work which I observed in the field, but I can state that, under the conditions which prevailed, a longwall 360 ft. in length worked very successfully, while shorter lengths of face gave considerable trouble. In one case, due to convergence of two gangways, a longwall of decreasing length was worked, and as the length decreased, trouble began to be experienced because the roof would not break and therefore threw excessive weight on the steel props and the longwall face. This condition became so bad that when the length of face decreased to 120 ft., the longwall method of working had to be abandoned. This agrees with the conclusion that for a given condition there is a minimum length of longwall which can be satisfactorily worked. My observations also lead me to believe that there is a relationship between the span at which the overweight fails as a beam and the minimum suitable length of longwall face. However, due to the fact that I have had no opportunity to make precise observations since I read this paper, I cannot say how closely his numerical ratios agree with an actual case in the field.

Fig. 4—Face retreat. *B*, 3/16 in. (1918 ft.) rotating at 2,350 r.p.m.; model ratio, 1268.

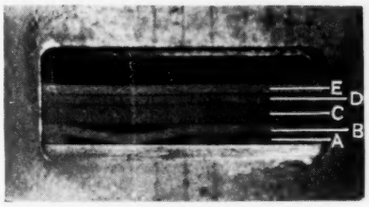


Fig. 3A—Model, 2.25 in.; prototype, 238 ft.

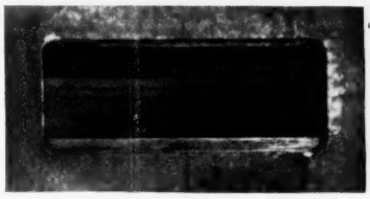


Fig. 3B—Model, 2.50 in.; prototype, 264 ft.

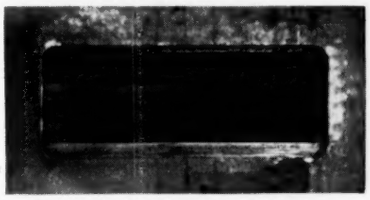


Fig. 3C—Model, 2.75 in.; prototype, 291 ft.

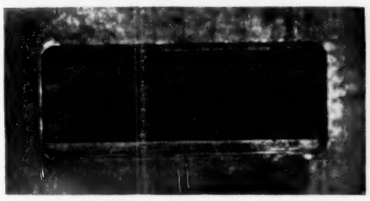


Fig. 3D—Model, 3.00 in.; prototype, 317 ft.

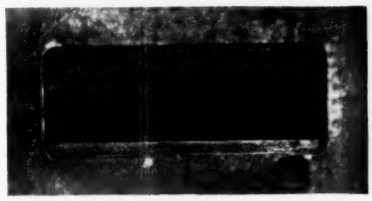


Fig. 3E—Model, 3.25 in.; prototype, 343 ft.

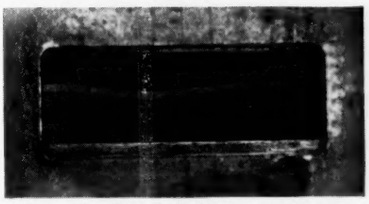


Fig. 3F—Model, 3.50 in.; prototype, 370 ft.

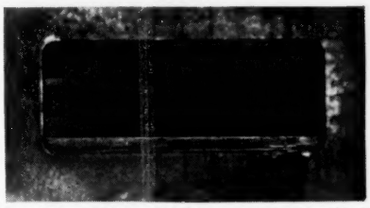


Fig. 3G—Model, 4.00 in.; prototype, 423 ft.

2. A cyclical variation in roof pressure was characteristic of the longwall work in the field. This conforms with his observation of periodic failure of the overweight, and his photographs of stressed models make the reasons for this cycle clear to us instead of a matter of conjecture as it formerly was. In practice we found that there was a certain phase of the cycle when a longwall face could be safely stopped and allowed to stand for an indefinite period of time, which also agreed with his conclusions.

"3. His conclusion that desirable longwall conditions are a thin strong underweight and a thick strong overweight also agree with my field observations."

What Field Tests Show

Mining plans of most stope-and-pillar or room-and-pillar mines call for rooms and stopes of a constant dimension. On recent examination, study and tests of a coal-mining property, the laboratory results showed that in certain sections of this mine the room span should be 24.8 ft. Present practice is to have 24-ft. rooms, which was arrived at on the basis of practical experience. The tests and study also showed that large areas could have 40-ft. rooms and other areas 60-ft. rooms. The change in room span was due not so much to variation in roof strength, which was less than 10 per cent, but to variation in roof thickness and overburden. It brings home the interesting point that in these days of mechanization a knowledge of what can be done in each portion of the mine will have significant effects on costs and profits.

(A succeeding article will give further details on the application of barodynamics and show how some interesting new physical tools and ideas may contribute to the advance of the coal-mining industry.)

HAMMOND'S NEW BREAKER

Receives Coal Under Six Inches To Screen and Clean to Egg and Minor Sizes

Signalizing the fact that with time has come great progress in the final preparation of coal and relatively little in the preliminary stages, the Hammond colliery continues the use of the structure and equipment of the upper floors of the old stepped, or gravity, breaker and puts the preliminary product thus obtained, ranging from 6-in. down, through a brand new modern breaker erected at the foot of the hill, where, by screening, breaking and cleaning, the final preparation is completed.

ONE of the newly established properties of the Western Middle Anthracite region is the Hammond colliery, between Shenandoah and Girardville, Pa., operated by the Hammond Coal Co., formerly by the Philadelphia & Reading Coal & Iron Co., on leases from the Girard Estate. Thus far, much of the intended reconstruction and reequipping underground has been judiciously delayed until the extraction of the pillars in the Third and Fourth levels has been completed, and further development, while already under way, will not receive its finishing touches until need for them arises, as it will when coal is being extracted from the Fifth Level. This level will be in active production in a few months.

On the surface, on the other hand, a need that could not wait was for equipment to make the final cleaning and screening of the coal such as to meet the requirements of the market; hence, a final preparation plant has been erected to prepare the coal scientifically after it has had a preliminary preparation in the old breaker on its bull shakers, its crusher and picking table. This breaker, fortunately reaching by steps up to the top of the hill, could have its lower half demolished without destroying the effectiveness of its upper half.

A bridge, or gantry, along which travels a 42-in. belt conveyor, covered by a hood, connects the new and old parts of this composits structure. The bridge itself is symbolic of the progress in breaker construction, for it emphasizes that, even when most of the sizes are cleaned separately and have to be sized before cleaning, the modern breaker so remarkably compresses its operations that a bridge and a belt 171 ft. long between centers has had to be provided to span the wide hiatus arising from the rebuilding of a mere half of the entire structure. This compression also interposes between the old wood structure and the new steel building, a clear space which reduces greatly the fire risk. The new construction, moreover, is much narrower than the old.

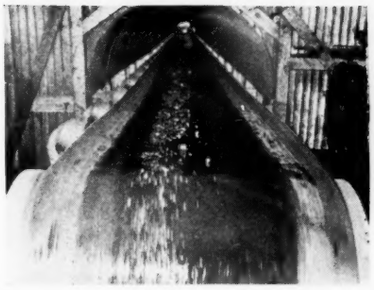
Coal received from the preliminary plant is screened in the new structure and that which ranges from egg to nut is cleaned by sand flotation in a single cone, whereas the fine sizes from pea to No. 4 buckwheat are separated from their refuse in five separate Hydrotators, each of which sizes has its own unit. Thus, difference of size does not complicate separation problems.

Deep-mine coal is cleaned during the day during a shift lasting from 7 a.m. to 2:30 p.m. Bank coal is treated during the shift following, from 4 p.m. until 11 p.m., and in no way is it mixed with the deep-mined material. Separation gravity in the cone is 1.72. Barley and rice from the plant is in part marketed and in part used at the boiler plant located alongside the breaker on the top of the hill, where it raises steam for hoisting, operation of the fan, and heating of the plant.

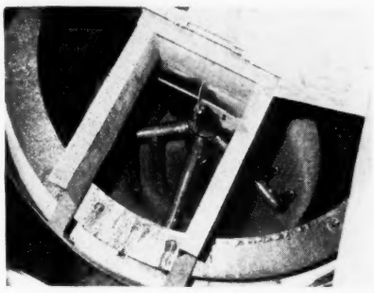
The coal, which consists of all sizes from dust to "broken," arrives at the new breaker from the old at a level of 98 ft. 9 in. above the rail on the siding, and is separated on a screen with 3¼-in. round holes. Oversize goes to 36x46-in. rolls in which it is broken to egg-and-smaller. This coal is joined by the undersize from the 3¼-in. screen and falls onto the top of another screen of the same size, which is the top member of a four-deck shaker. What does not pass through is carried back by a 6x18-in. scraper conveyor to a 36x52-in. roll crusher located alongside the crusher already described, forming in this way a closed circuit that assures that no coal larger than egg will eventually leave the crusher.

From this point the current of crushed coal splits and is divided between two sets of four decks each, the top deck delivering oversize, as already stated; the second deck, a mixture of egg, stove and nut; the third, pea, and the fourth No. 1 buckwheat. Undersize from this fourth deck passes to a two-deck shaker, where the product is separated into rice, barley and undersize. The composite size, egg-stove-nut, travels to a 15-ft. Chance cone.

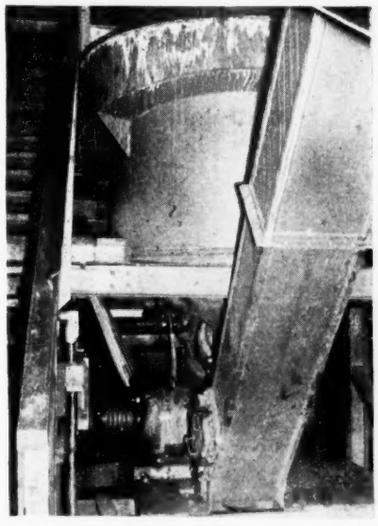
Undersize from the barley shakers goes to single-deck shakers with ⅝-in. round-hole screens which make No. 4 buckwheat and an undersized product which travels, at present, to the slush hopper and thence to a waste pile of its own. Pea goes to a Hydrotator of 5-ft. diameter having for that size a capacity of 55 tons per hour. Buck-



Where the stream of 6-in.-and-under coal comes on a belt across the bridge for final preparation.



Interior of one of the upward-current-type classifiers taken when empty so as to show the revolving manifold through which water enters.



Exterior view of one of the upward-current-type classifiers as seen from the floor below. On the left is the pump and on the right the refuse conveyor of the unit.

wheat, rice, barley and No. 4 buckwheat travel each to its 6-ft.-diameter Hydrotator for treatment. Each of these five units has its own dewatering and sizing screen. Hydrotators of this type were described in *Coal Age*, June, 1939, p. 49.

Capacities for these cleaning units vary with the quantity of impurity to be removed, with the character of the raw coal and with variations in the requirements as to ash in the cleaned coal and as to freedom from undue coal in the refuse. A 6-ft.-diameter Hydrotator cleaning No. 4 buckwheat will handle about 38 tons per hour. With larger sizes of coal the capacity will increase; thus, cleaning barley, the same size of Hydrotator will treat about 45 tons hourly, and with rice will handle about 60 tons.

The coarse refuse from the Chance cone goes with the finer refuse from the five Hydrotators direct to the refuse pocket without further cleaning, though in many breakers the Chance refuse is cleaned in rock jigs and recrushed, to separate coal from impurities, for further treatment. Separate pockets are provided for the loading of both types (deep-mined and reclaimed) coal.

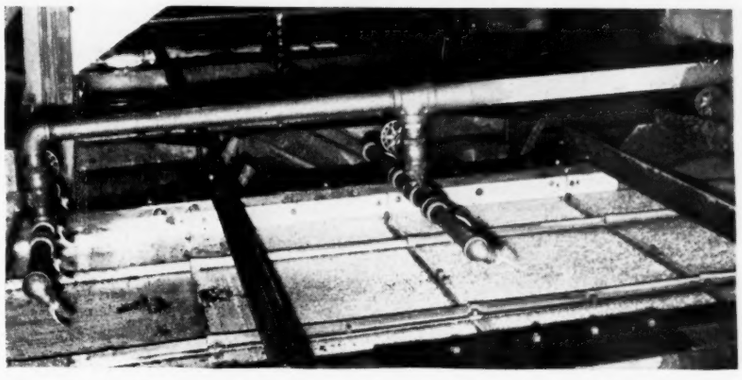
However, the companies in earlier years put their entire fine product regardless of its purity or impurity on the bank, because the public, not having equipment to handle such fine coal, would not buy it. In consequence, the fine coal on the bank will have the same range of coal purities as exists in the coal being freshly mined. Hence, after cleaning, which removes the high-gravity material, the fine bank coal will have the same degree of purity as coal direct from the mine; in fact, it may have more, for sometimes not a little soluble material will have been dissolved by the rain and carried away, and some oxidizable material, like pyrite, will be so changed as to become soluble and so removed in like manner. Nevertheless, at this breaker, bank coal is kept separate always from more virgin material.

All pockets deliver direct to the railroad cars through chutes equipped with lip screens and the fine material passing through these goes to the conveyor pit which also receives condemned coal. A 6x18-in. scraper flight conveyor passing toward the boiler house raises this coal to a screen where the larger sizes are removed. These go to the top of the new preparation plant for recleaning and sizing, and the finer sizes travel to the boiler plant by another conveyor. These latter sizes consist in the main of barley and rice.

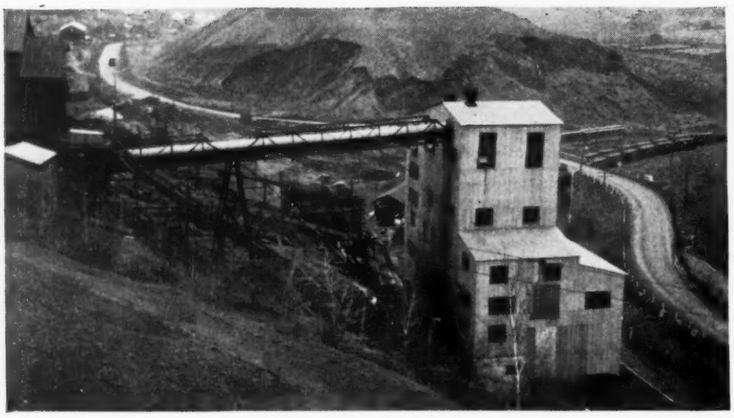
About 1,400 g.p.m. of water, usually mine water, is used for make-up purposes and about 1,600 g.p.m. is recirculated, these figures including both Chance and Hydrotator water. This recirculated water is derived from the Hydrotator sump overflows and consists of 850 g.p.m. of spray water and of 750 g.p.m. derived from float-control water. The tank in which this water is collected is just below the Hydrotator floor behind the pockets and the lift accordingly is greatly reduced. Located where it is, it prevents vibration in the preparation plant. Its only solids are particles of No. 4 buckwheat and smaller from the Hydrotator overflows, and these pass readily through the relatively coarse spray heads provided.

Already is passing the belief that heavy sprays are needed to drive unwilling fines through the screens by violence. The sprays at this plant are relatively gentle and applied at the lower end of the screen. They seem to carry the coal in suspension through the screen openings rather than to propel it through by dint of pressure. Some, today, are using leaky water boxes just to keep the coal well wetted and provide for a loosening of the bed that will let the fines through, and others are stressing using plenty of water at the top of the screen that will have the same result.

When the Hydrotators have been cleaned out and a restart is made, the water from the slush hopper is fed into the several pea, buck and rice Hydrotators in order to raise the



One of the dewatering screens which removes water and undersize from the over flow coal of the upward-current-type classifier.



New Hammond preparation plant showing on the left the remaining part of the old breaker in which the preliminary crushing and hand picking are performed, with the conveyor-belt bridge between the old and new structures.

gravity and so provide for the proper operation of these units in a dense medium, so that all the sustenance will not have to be provided by the upward currents. This process provides an effective separation at about 1.80 specific gravity.

Though the material is closely sized, a little high-gravity support nevertheless helps to equalize the sustension of particles regardless of their differences in shape and dimension. Especially is that true of pea, which has a fairly wide range in the latter characteristic. Recirculation of buckwheat No. 4 assists in such suspension. Ultimately almost all of it finds its way to the pocket for that size of coal.

So far, it has not been found necessary to neutralize the water at the Hammond colliery. Sand for the plant comes from southern New Jersey. It should be of reasonably uniform size and between 30- and 100-mesh material. Standard tolerances are 5 per cent above 30-mesh and 5 per cent below 100.

All power for the plant is purchased from the Pennsylvania Power & Light Co. and arrives at 66,000 volts to be stepped down to 440 volts. Power factor during the month of March was kept up to 94 per cent, thanks to use of three 500-hp. synchronous motors on the mine pumps, one synchronous motor on a 200-hp. motor-generator set and a 225-hp. synchronous motor for a compressor unit.

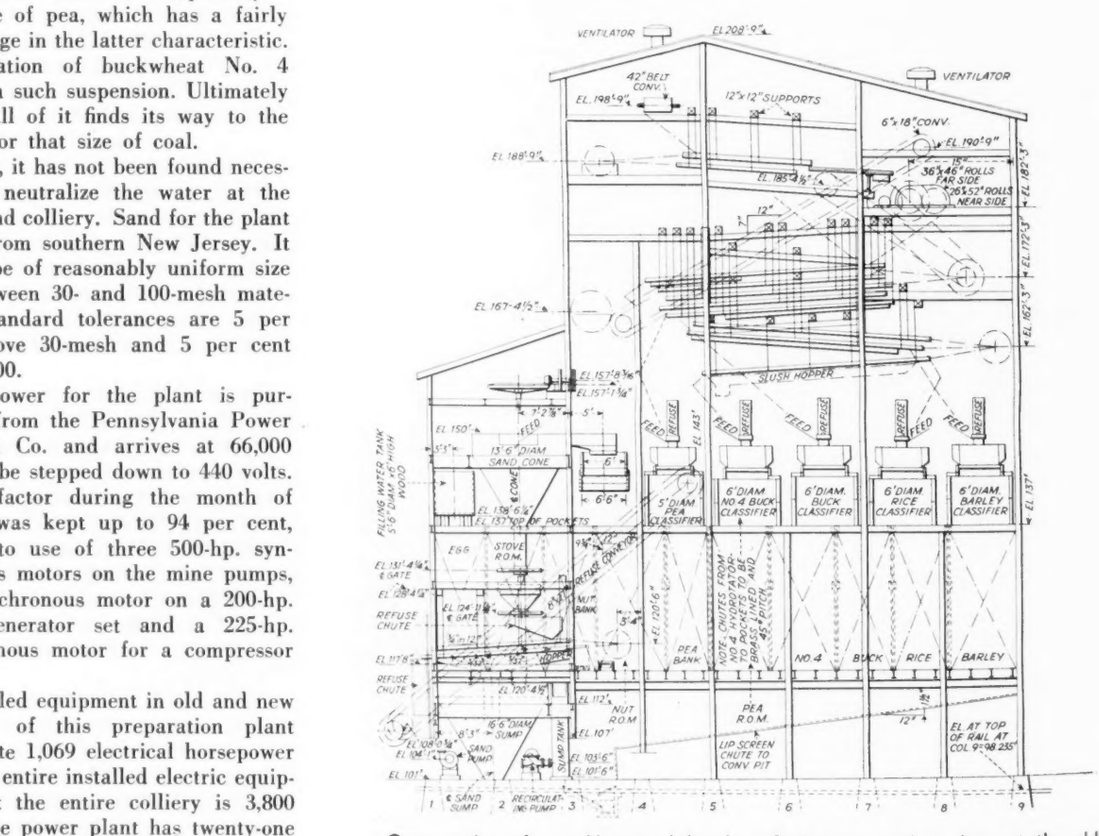
Installed equipment in old and new sections of this preparation plant aggregate 1,069 electrical horsepower and the entire installed electric equipment at the entire colliery is 3,800 h.p. The power plant has twenty-one 125-hp. boilers, but only fifteen of these are in use. The intention is to provide boilers later that will permit of the replacement of rice and barley by No. 4 buckwheat.

Constructors of the steel work of the plant were the Weatherly Steel Co.; timber work and general contract work, including erection of machinery, was performed by E. E. Reilly; Hydrotators and their subsidiary equipment were supplied by the Wilmot Engineering Co., and the sand flotation cone by Staples & Sweeney.

Quite briefly, the mine may be described as being on the north side of a basin running east and west with the shaft located beyond the north edge of the outcrop of the lowest of the beds so as to be entirely beyond the operating area. No buildings except the mine office and parts of the breaker have been erected over the coal beds.

Operations have reached the Fifth Level, which is just about at the level of the sea, a depth of 1,500 ft. below the hoist house. A tunnel 1,500 ft. long connects the shaft with the coal bed. A sixth level can be constructed at the bottom of the basin, but it will not be connected directly with the shaft but through a slope from the Fifth Level. The other levels are connected also with the shaft by cross-measure tunnels.

R. L. Birtley is president; Willard Birtley, preparation manager; J. R. Brydon, Jr., mining engineer; Bert Lewis, treasurer and purchasing agent. The mine allocation is 1,500 tons daily, to which must be added the bank coal, a total of 2,100 tons. The new breaker was completed in its present form last February.



Cross-section of new Hammond breaker. Preliminary work is done at the old breaker on the top of the hill. Sand cone cleans egg to nut inclusive and upward-current-type classifiers remove impurities from all sizes below chestnut.

Stripping with 12-yd. electric shovel at Millstadt. In background is walking dragline used in benching off 12 ft. of surface.

SHOVEL AND DRAGLINE

Uncover No. 6 Seam at Millstadt Where Coal Is Hauled in 30-Ton Trailers

TO PROVIDE washed coal for the production of "Solarite" smokeless fuel in the carbonizing plant described in the May issue of *Coal Age*, p. 33, and also to produce a low-ash well-prepared bituminous coal for the St. Louis industrial and domestic market, the Midwest-Radiant Corporation operates a modern strip mine for the recovery of No. 6 coal near Millstadt, St. Clair County, Ill. Stripping is done by a 12-yd. electric shovel in conjunction with a 2-yd. diesel-powered walking dragline, loading by a 3-yd. electric and a 1¼-yd. gas-air shovel, and hauling by gasoline tractors pulling 30-ton bottom-dumping semi-trailers. The stripping equipment in service is able to uncover some 65,000 tons of coal per month in overburden averaging 35 ft. in thickness and varying from a minimum of 20 to a maximum of 50 ft.

With a 2-yd. walking dragline benching off the top, stripping at the new Millstadt plant of the Midwest-Radiant Corporation is done by a 12-yd. electric shovel. The two units working together can uncover 65,000 tons of No. 6 coal averaging 6 ft. in thickness a month in 35-ft.-average overburden, which is drilled horizontally and shot with black powder. Two loading shovels place the coal in 30-ton tractor-and-semi-trailer units for transport to the preparation plant.

Average thickness of the seam at Millstadt is 6 ft.; maximum is 8 ft. Underneath the coal is fireclay and over it is 0 to 3 ft. of black slate, above which occurs some 0 to 14 ft. of limestone capped by loess and surface soil. Total thickness of the hard material, however, seldom exceeds 12 to 14 ft. Operations are under the general direction of Kenneth A. Spencer, vice-president in charge of the corporation's coal division. Harold N. Hicks is resident manager of the coal division. W. Winters is pit superintendent, H. W. Brentz is preparation manager, F. R. Schroeder is engineer, and I. V. Curtis is chief electrician.

Average cut width is 50 ft., and pit width, including a 15- to 20-ft. berm for the haulage units, is 65 to 70 ft. The hard material in the overburden must be shot. Drilling is done with a company-built 440-volt horizontal drill making holes about 4 in. in diameter. These holes are loaded with black

powder with a 40-per-cent dynamite primer. Holes are drilled in the black slate and if this slate is absent are put in the coal directly under the limestone. This is necessary because of the limited thickness of the limestone and the fact that it cracks up easily, which makes it necessary to have as much solid material over the charge as possible to prevent it blowing up and out under the loess. Shooting with the charge on the seam, contrary to expectations, does not break up the coal.

With 12 ft. of hard material, hole spacing is about 18 ft. In thinner material, the spacing is adjusted accordingly. All holes are drilled horizontally the full 50-ft. depth of the cut. In 12-ft. rock, the usual charge is 145 lb. of powder. In 6-ft. rock, as little as 50 lb. of explosive will serve.

The stripping shovel is a 4,160-volt 385-B Bucyrus-Erie machine with 12-cu.yd. dipper, 90-ft. boom and 56-ft. sticks. It is preceded by a 2-W Monighan walking dragline (diesel-powered) which benches off 12 ft. of the top, leaving the rest for the stripper, which is accompanied by a Caterpillar RD-7 tractor with La Plant-Choate bulldozer to assist in the clean-up.

The coal is shot before loading, using holes put down by a company-built vertical auger. These holes are loaded with pellet or, where the coal is tight on the bottom, 40 per cent gelatin. Loading originally was done by a 4,160-volt 50-B Bucyrus-Erie shovel with a 3-cu.yd. dipper. As this shovel is unable to take the full 50-ft. width of coal without changing position, the practice was to load out one strip as wide as possible and then back-track on the remainder, or "rib," leaving a 15-ft. berm for the haulage units. A Bucyrus-Erie GA-3 gas-air unit with 1¼-cu.yd. bucket went into service in December, 1939, however, and the present practice is to operate the two in tandem, with the 50-B taking the major cut and the gas-air unit the rib. The top of the coal is cleaned before loading.

Hauling from the pit to the preparation plant is done by four gas-powered units, each made up of a Dart 250 tractor (Hercules "HXE" engine) and a United Iron Works Co. 30-ton drop-bottom semi-trailer. Round trip at present is around 1½ miles. Pit length is about 4,000 ft., and it is entered by four runways—one at each end and two spaced out along the intervening length. Main roads are built of crushed limestone produced on the property, with an oil top. As a result of a happy combination of natural conditions, no inclines into the pit are necessary, as the roads and runways are nearly level. By the same token, the pit is self-draining except for local swags, which are dewatered by gas-powered pumps with hoses for suction and discharge.

Power to operate the pit equipment is brought in by pole line, from which laterals 1,500 ft. apart are extended to the top of the bank. Both the stripper and electric loader are equipped with 1,320-ft. cables.

Loading coal in Millstadt pit, showing 30-ton semi-trailers used for haulage. The 1¼-yd. gas-air shovel normally used with this larger machine was working elsewhere when this illustration was made.

FUNDAMENTALS OF SELECTION

And Correct Application

Of Electrical Equipment for Coal Mines

Delays and breakdowns always are costly. In selecting electrical equipment for coal washeries, therefore, the buyer may well ask: Is it simple, adequate and foolproof? And will it stand up under the tough service it must perform? Out of his long experience in this field, Mr. Richart gives the reader some plain-spoken advice and practical help in the care and selection of preparation-plant electrical equipment and how operation may be improved.

By FRED W. RICHART
Special Contributor to Coal Age

LIKE most continuous manufacturing processes, coal-washery operation should not be interrupted during the working shift. Electrical equipment, therefore, should be simple, adequate and foolproof. The material handled is dusty, some of the impurities gritty, and others more or less soluble in water. Inasmuch as the washing media—whether water, water-chemical, water-sand or air-sand—are all inimical to electrical devices, choice of equipment must be made with that fact in mind. Three other factors also enter into the selection: (1) slow-speed machinery, as conveyors and valve mechanisms; (2) machines requiring variable-speed drives, and (3) the question of power factor as affecting conductor and transformer capacity, and power bills.

The present-day accepted standard for power supply within the washer is 440-volt, 3-phase, 60-cycle. There are no serious objections to 440-volt distribution. The saving in wiring and motor-control cost is considerable in comparison with 220-volt distribution. Both these voltages, however, can be made available, at the same time if need be, from the standard 2400 to 240/480-volt, 3-phase transformer bank, operated from nominal 2300-volt delta or from 4000-volt "Y" power supply. Transformers are name-plated for 2200-, 2300- or 2400-volt supply. The secondary voltage, of course, is proportional to the applied primary voltage. In actual practice, this primary voltage may vary quite widely.

Special transformers with non-inflammable synthetic cooling oil are more expensive, but it is conceivable over-all cost of a plant so equipped need not be greater than where oil-filled transformers are used. Moreover, they have these advantages: the liquid cannot start or support combustion; underwriters permit installation indoors in the open; installed at load center, secondary wiring will be less expensive.

Pellet or autovalve lightning arresters are satisfactory for the protection of transformer installations of moderate size and on primary circuits of 6900 volts and less. Large and expensive substations justify more expensive arresters. Transformer stations fed by long power lines justify the added protection of a second set of arresters 1,500 or 2,000 ft. from the station protected.

Fuses as the short-circuit protection for transformer banks are open to serious objection on 3-phase power circuits. Single phasing is possible with resultant damage to motors if overload relays fail. Contacts become corroded and resistance losses may cause fuses to blow when no actual overload exists. Extra fuses are not always quickly available.

Modern practice leans decidedly to the use of oil circuit breakers for power-transformer protection on circuits of 5000 volts and under. Interrupted power can be restored immediately and by remote control if that is desirable. Non-inflammable oils in oil circuit-breakers quench the arc and will not burn, but liberated gases are corrosive to breaker contacts. So manufacturers stick to the use of mineral oils. Disconnects should always be placed ahead of substation circuit breakers.

Waterproof oil circuit breakers are available but do not have some of the variable control characteristics that are often desirable. Today's standard oil circuit breakers are satisfactory. Induction overload relays are adjustable to meet any requirement. Such breakers can be so located in the washery that no flooding water can reach them.

A modern preparation plant for a 5,000-ton mine requires approximately a 1,500-kva. transformer station. At 460 volts secondary, the current per phase at full load is nearly 1,900 amp. Two 1,750,000-circ.mil cables per phase are necessary. However, if this is split up into four cables, we can use 600,000-circ.mil cables and save 1,100,000-circ.mil of copper. If there is a long run and the cables can be put underground, not in ducts,

the carrying capacity will be increased 25 per cent for summer weather and more for winter.

Copper usefulness decreases with increased size of cables. This is due to loss in relative heat-radiating capacity. Confining several conductors in one duct has the same general effect. Multiple conductors must be spread out to get the benefit of heat radiation. This cable question deserves more consideration than it usually gets.

Current demands of a large washery are so high it also is wise to split the low-voltage side leading from the transformer station into several circuits, to bring the oil circuit breakers into the moderate price range. By doing this the oil breakers on both high- and low-voltage sides may probably be made duplicate—an important step toward standardization. Breakers on the low-voltage side should be non-automatic and do not need disconnects in front of them, since, in the remote event of breaker failure, the plant will be shut down anyway. Air breakers can be used but oil breakers are decidedly preferable and usually less expensive. Fuses should never be used in any power circuits. They are a potential source of annoyance and unnecessary expense.

For all but a few special applications, squirrel-cage motors provide the simplicity and trouble-free characteristics so desirable in mining operations. Since the rotor is the only thing that need be changed to provide the various characteristics of normal torque, high torque or high slip, squirrel-cage motors are the nearest approach to renewal-parts perfection. The one important application for a slip-ring motor is the raw-coal belt or conveyor. A slip-ring motor permits controlled time acceleration with the lowest possible current input and variable speed if required. Every motor in a coal washery should be ball- or roller-bearing. The power saving may be small but modern anti-friction bearings keep out the dust, have a demonstrated long life, and will stand up under some kinds of abuse much better than sleeve bearings.

Dustproof cross-the-line motor control.

Weatherproof control bench.

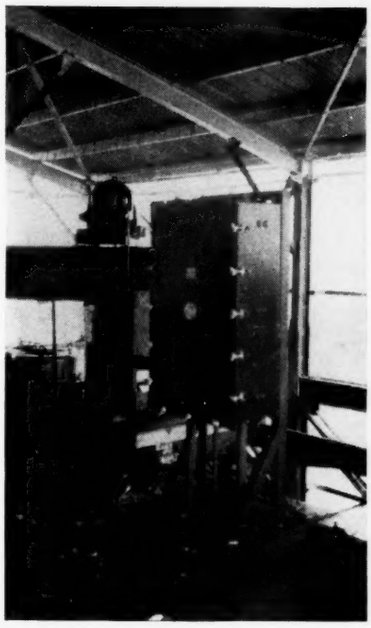
Inclosed Motors Best

Now comes the point where Mr. Purchasing Agent will want to know why a motor is not always a motor so long as it will deliver the required torque. This is the question of open vs. some type of inclosure. "Now that grease-sealed bearings have been decided on, isn't that enough?" It is true insulations have been made better and better. We hear stories that Dixie Coal Co.'s motors were accidentally covered with water and still operated, so why worry? But every motor won't take it. We are in a business where continuous service is worth a premium: well worth the insurance inclosed or splashboard motors cost.

Normally, of course, the modern washery will not spill over. But accidents may happen. Many things can cause water to spill over: broken conveyors, heavy gob accumulation, a stalled motor, breaking in a new man. Even pipes wear out and leak; joints corrode; they clog up and workmen take them apart to clean them out; and if there is electrical equipment in reach it is just too bad. There are two things that can be done about it: Install no motors under tanks, sluices or even under pipes; use motors so built as to prevent water reaching conductors, windings or connections.

Standard motor control is available in dustproof or weatherproof inclosing cases. From the viewpoint of the safety engineer nothing less than dustproof should be used. From the operator's point of view, short-circuit protection should be an air circuit breaker and the inclosure should be weatherproof. Experience indicates that any fuse about a washery is a nuisance and that any standard thin-metal inclosure is an invitation for miniature dust explosions that may produce more or less serious personal injury. A number of such cases have happened.

Other hazards for open control are



Dustproof reduced voltage starter.

chemical fumes and the mist from waxing coal. It takes weatherproof inclosures to protect control from these hazards. A type of control which meets all these conditions is the combination air circuit breaker and across-the-line contactor, equipped with temperature overload relay, all inclosed in a single weather-proof case. The circuit breaker is arranged to be operated by hand and the contactor is operated by remote pushbutton station.

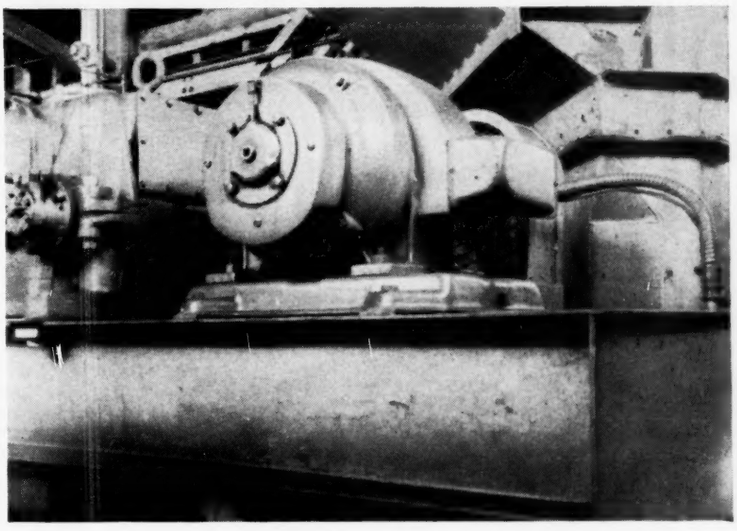
Underground mines have relied on their motor-generator sets to maintain a satisfactory power-factor condition without taking time to figure the operating cost. This question apparently has been considered only from the power-bill point of view. It is apparent much intertransfer of current and C^2R losses could be eliminated by correcting the washery power factor at the source. Importing correcting current from miles away certainly is not good engineering. The very few capacitor installations in the central west have been eminently satisfactory. Plant design based on a power-factor study might go far to offset the investment cost of a suitable capacitor at the source of the evil, which is within the washery.

What of synchronous motors? Consider a plant with 1,600 hp. of motors which will average around 25 hp. each. The largest may be 125 hp., will drive the main conveyor and, most likely, must be a slip-ring motor—certainly not a synchronous motor. There will be a few pump motors and one or two crusher motors around 75 to 100 hp. each. As a whole, the plant will be 80 per cent loaded and the power factor about 0.82. The load will be 1330 kw. To correct this load to 95 per cent power factor will require 480 reactive kva. The aggregate of large motors is so small that very special synchronous motors would be required to obtain the needed capacity. The cost would be excessive. In addition, the complication of exciters and control would call for special protection and attention scarcely possible in a coal washer.

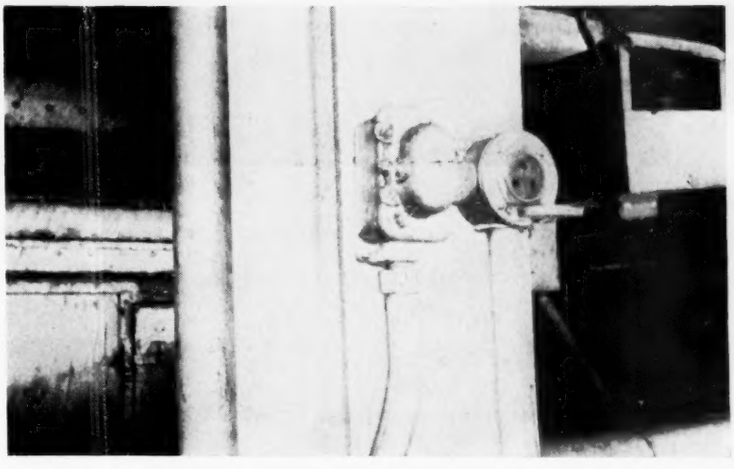
The efficiency of capacitors is better than 99.7 per cent; they are extremely simple; there are no moving parts; there are almost no failures. They can be placed out of the way. The cost will certainly be as low, when all factors are weighed, as the extra cost of synchronous motors.

Washery accessories are lighting, a portable-tool power circuit, an arc-welding circuit. Independent transformers should be provided for the 110/220 combined lighting/tool circuit. Vision and power are both necessary when plant power is off. That is often a condition when repairs must be made. The tool circuit will be found of the utmost utility.

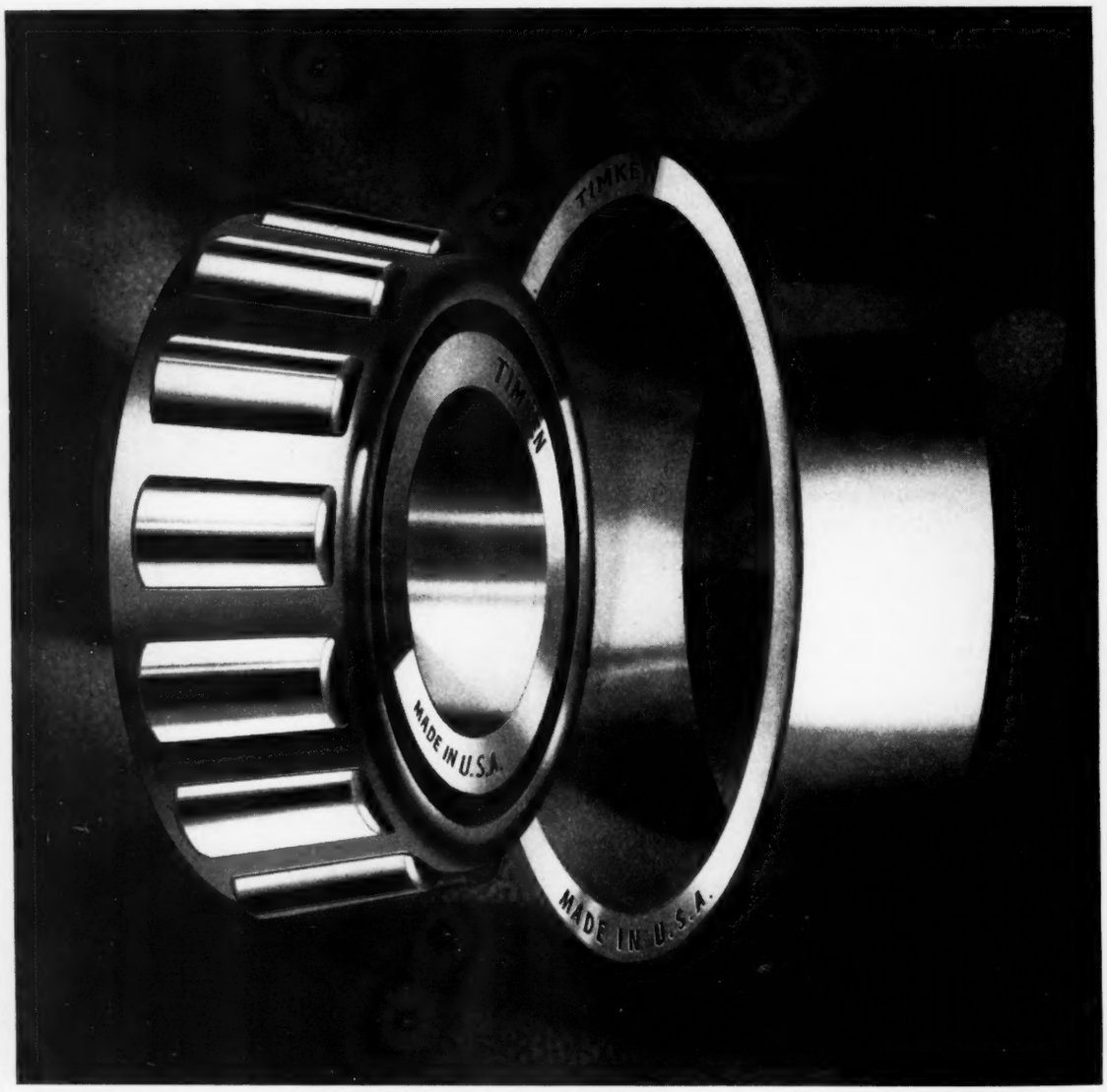
Electric arc welding has become one of the most used tools in industry. With washery repair and changes a daily job, one of the short cuts to quick work is a welding tap within 50 ft. of all points. The welding generator should be conveniently located and be driven by a power supply independent of the washery. A permanent welding circuit, with receptacles on each floor, will complete this essential job.



Splashproof 440-volt motor driving washing cone.



Portable-tool power receptacle.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The TIMKEN Bearing of today is the finest tapered roller bearing that has ever been made. Timken history over a period of 42 years is a story of continual improvement in bearing design—in fact Timken has pioneered every important refinement and improvement ever made in tapered roller bearings. Among these Timken achievements are: the one-piece multiple perforated cage; TIMKEN Electric Furnace Alloy Steel; TIMKEN Bearing surface finish, the finest finish known to modern bearing science; and wide area contact between the ends of the rollers and the under-cut rib of the cone, thus assuring accurate roller alignment around the periphery of the raceways, without which high bearing speeds would be impossible.

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When you install TIMKEN Bearings you are not experimenting. You get both of these two important basic factors that are so necessary for dead-sure, satisfactory bearing performance: *first,* correct design, material and construction; and *second,* 42 years of engineering experience in applying bearings.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

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WASHING EVERYTHING

New Millstadt Preparation Plant Includes 1,700-Ton Truck-Loading Facilities

Washing everything after reduction to 7 in. and shipping entirely by truck, the new Millstadt (Ill.) preparation plant of the Midwest-Radiant Corporation includes a 1,700-ton storage and truck-loading plant. With a capacity of 350 tons per hour, the operation employs a transfer house for preliminary preparation, lump picking and crushing facilities, and two wash boxes for final cleaning.

By H. W. BRENTZ
Coal-Preparation Manager, Midwest-Radiant Corporation
And IVAN A. GIVEN
Associate Editor, Coal Age

TO SUPPLY a uniform low-ash and low-sulphur coal to St. Louis consumers, as well as furnish coal for the production of "Solarite" smokeless fuel in the carbonizing plant described in the May issue of *Coal Age*, p. 33, the Midwest-Radiant Corporation completed a new coal-preparation plant in January, 1939, for washing the entire mine production after reduction to 7 in. As the entire output moves to market or the Solarite ovens by truck, a 1,700-ton storage and loading plant accompanies the washing and screening installation, which is preceded by a breaking and picking plant for preliminary treatment of coal from the pit.

Built near Millstadt, St. Clair County, Ill., some 15 miles southeast of St. Louis, to clean and prepare coal from the No. 6 seam, this preparation plant, designed and erected by Jeffrey, has a rated capacity of 350 tons per hour and has been operated at as high as 480 tons per hour without appreciably affecting preparation results. Coal from 7 in. down to ¾ in. is cleaned in one wash box, with a second unit for minus ¾-in. coal. And, to insure ultra-clean screenings and at the same time improve the operation of the coarse-coal washer, fine middlings are recirculated to the coarse-coal unit, which also receives, after crushing, a portion of its own middlings. Lump pickings also are crushed and washed to salvage the merchantable coal, and lump itself is reduced to smaller sizes when there is no call for it.

Coal is dumped into a 50-ton concrete hopper from which it is withdrawn by a reciprocating feeder equipped with a Reeves variable-speed drive controlled from the washer operator's station, where a tachometer shows the feeding rate. From the feeder the coal is elevated to a "transfer house" and discharged onto a shaking picking table preceded by 2½-in. bar screens. Minus 2½-in. raw coal goes directly to the conveyor feeding the main plant, while the plus 2½-in. size, after picking, also is run to the same conveyor. Provisions have been made to install a breaker after the table to reduce lump to a maximum size of 9 to 10 in.

From the transfer house the coal is elevated to two mine-run shakers. The upper shaker, 6 ft. wide and 23 ft. long, is equipped with 108 sq.ft. of ¾-in. round-hole plate. The lower shaker, 6 ft. wide and 33 ft. long, including the table and discharge chute, is equipped with 48 sq.ft. of 7-in. plate for making lump and 7x¾-in. coal. The lump, after picking, goes off the end of the table onto an apron-type truck-loading boom if a truck is calling for coal. Otherwise, it falls through a gate in the table to join the pickings en route to a United Iron Works Co. 24x48 single-roll crusher, which reduces the feed to 7 in.

Minus ¾-in. coal from the upper shaker flows into a 25-ton surge bin ahead of the fine-coal washer—a 6-ft.-wide three-compartment Jeffrey air-operated jig. This bin is equipped with "Bindicators" to show whether full or empty, with signal lights on the washer operator's control panel. A 3-in.-wide flat plate is installed on the bin discharge, on which are welded fingers—3 in. apart—of reinforcing bar extending up on a 45-deg. angle. The function of the plate and fingers is to permit the coal to flow down to where the pulsation of the water picks it up and moves it into the jig, thus avoiding a rapid inrush with consequent disturbance of the washing bed. The 7x¾-in. coal from the lower shaker goes to a second washer of the same size and type.

The wash boxes each are equipped with three refuse draws, with material from the first in each case going to the refuse. Material through the second draw on the coarse-coal washer is passed over a bar screen (2- to 2½-in. openings), while material from the third draw goes over a ¾-in. bar

Right—Millstadt washing and screening plant with transfer house. Left—Truck-loading plant. This illustration was made on Sunday, which accounts for lack of activity.

screen. Undersize goes directly to bottom strand of the refuse conveyor, which discharges it into a 50-ton steel bin with undercut gate for truck disposal. The bottom of the bin is inclosed and a radiator is installed to prevent freezing.

Oversize from the grate bars and material from the second and third draws on the fine-coal washer fall into the top strand of the refuse conveyor and are carried back to a 24x24 single-roll Jeffrey crusher for reduction to minus 1½ in. The crusher product then is recirculated to the coarse-coal washer. Fines from Nos. 2 and 3 draws of the fine-coal washer are recirculated because the lowest-possible ash is desired for certain screenings applications, and to get this ash a high percentage of material must be rejected. To salvage some of the values in this reject, it is recirculated to the coarse-coal washer, where it also, in the opinion of the Midwest preparation force, results in a more fluid bed and better distribution of water by filling up voids.

Washed ¾-in. coal flows over a section of Bixby & Zimmer round-wire screen with ½-mm. openings to remove water and fine coal and then onto two high-speed shaking screens (5x26 ft.) each fitted with 96 sq.ft. of ¼-in. round-hole perforated plate for making ¾x¼- and minus ¼-in. sizes. Minus ¼-in. material falls onto a second dewatering deck on each screen fitted with 100 sq.ft. of ½-mm. bronze wedge wire. Fines through the wedge wire flow with the water to a settling tank. The ¾x¼-in. stoker and the ¼-in.x½-mm. screenings each may go into a separate compartment in a two-compartment distributing conveyor for transportation to the proper storage bins. Or part or all of the ¼-in.x ½-mm. screenings may be combined with the ¾x¼, with the rest in the second compartment.

Coal from the coarse-coal washer also flows over an unloading screen (½-mm.) onto two shakers, one 6 ft. wide and 28 ft. long and the other 7 ft. wide and 28 ft. long. The screens set one above the other and are fitted with 54 sq.ft. of 4-in. round-hole plate and 92 sq.ft. of 2-in. round-hole plate for making 7x4-in. egg, 4x2-in. nut and a minus 2-in. resultant. The latter falls onto ½-mm. wedge wire and B. & Z. round-wire screen for dewatering and removal of fines. These fines also go to the concrete settling tank, from which they are removed by a scraper conveyor.

At present, these fines are run to the refuse, but supplementary cleaning equipment is being considered to recover the coal. If this equipment is installed, it is the thought that all material from the Nos. 2 and 3 draws on both washers would be crushed to ¼ in. and re-treated in this plant, possibly to be supplemented by drying equipment. Reduction to ¼ in. is made possible by the fact that the Solarite plant is a good outlet for such material. Water from the settling tank is recirculated to both washers by a 7,500-g.p.m. Fairbanks-Morse pump. Both wash boxes also are supplied with

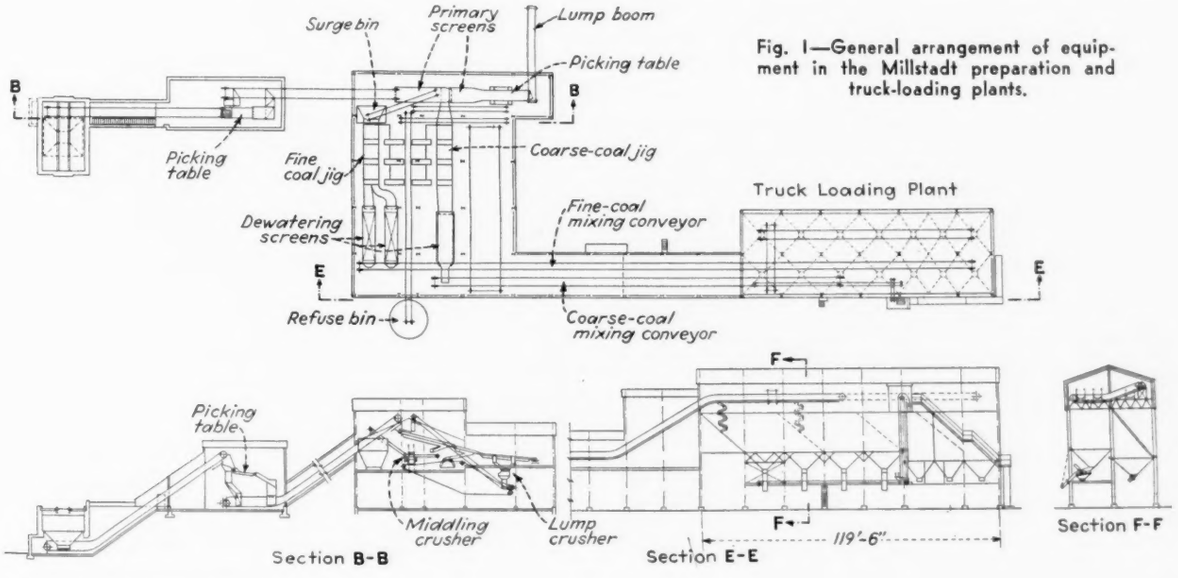
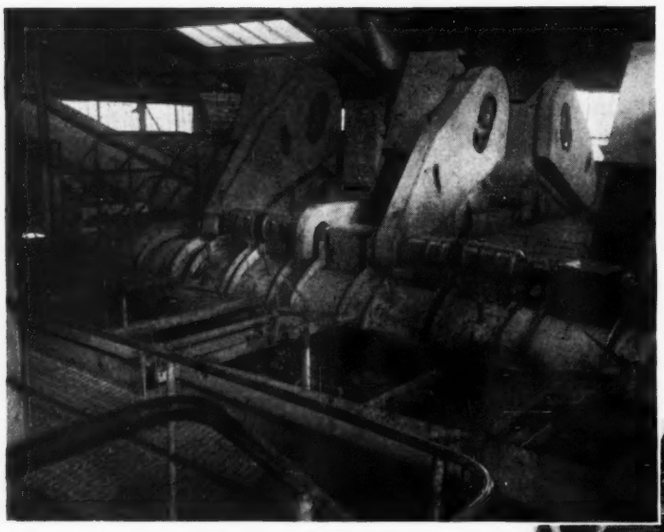
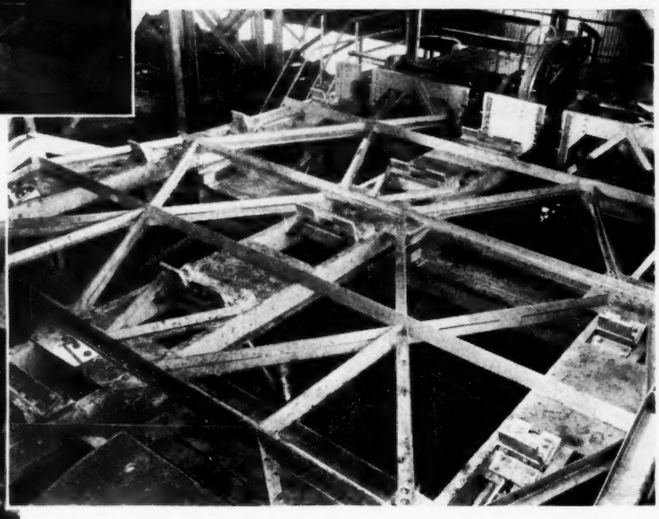


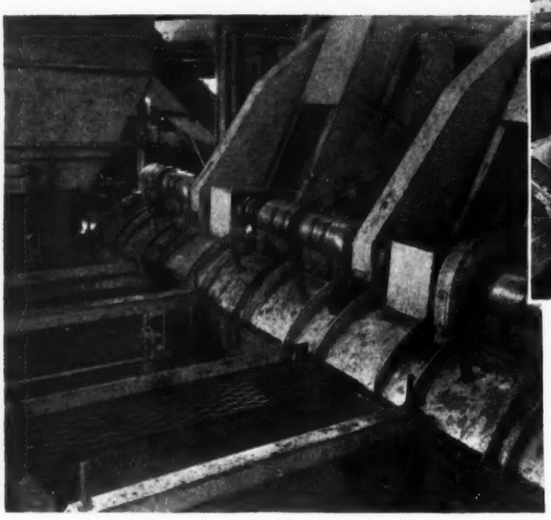
Fig. 1—General arrangement of equipment in the Millstadt preparation and truck-loading plants.



Millstadt coarse-coal wash box with part of plant control panel in rear.

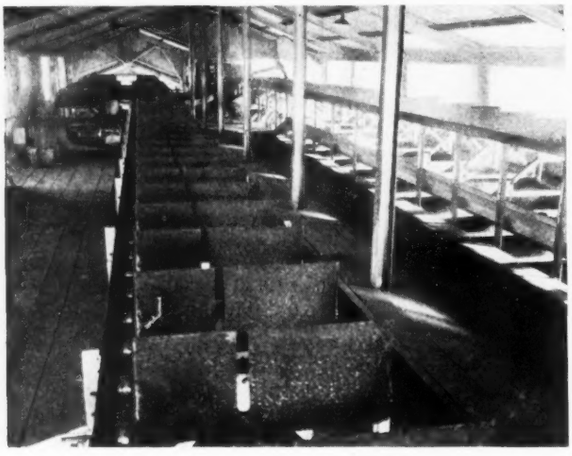
At far right are coarse-coal dewatering and classifying screens, with the two fine-coal screens in foreground.



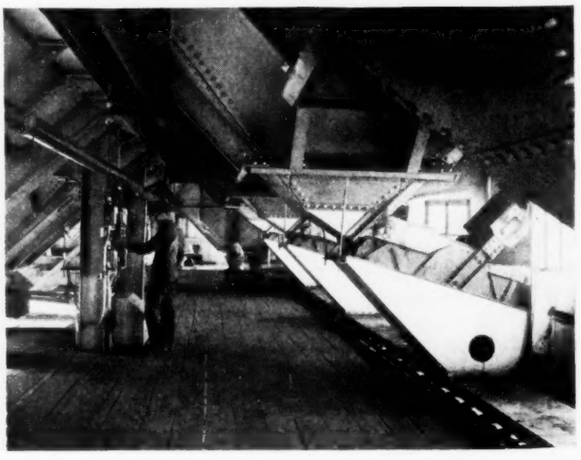


Millstadt fine-coal wash box, which is preceded by a 25-ton surge bin.

A view over tops of bins in track-loading plant. At left are two-compartment conveyors from main plant. At rear right is screenings sizer, while conveyor on right distributes screenings along the 900-ton bin.



Under the bins in the truck-loading plant. At right are part of the electric degradation screens for furnace, egg and 7x2, with the degradation conveyor beneath them. Gates at the left draw screenings out of the 900-ton bin.



air by an Ingersoll-Rand blower—3,700 c.f.m., 2½-in. pressure.

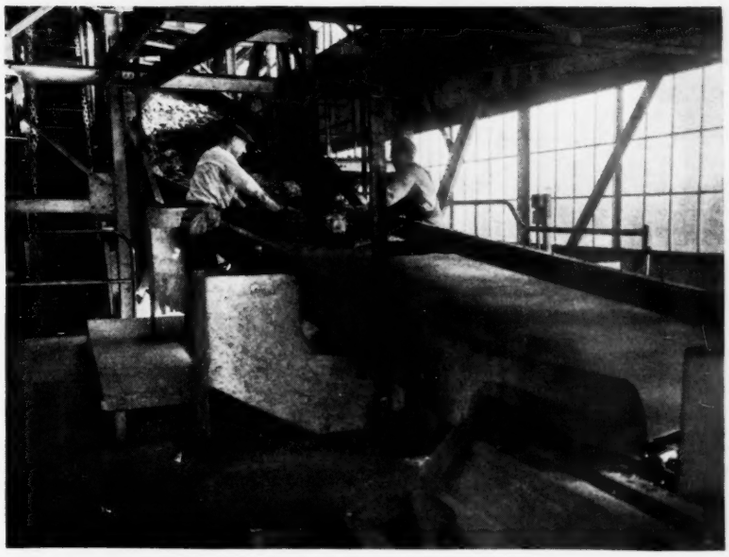
Furnace and egg from the coarse-coal classifying screens go into their respective compartments in a two-compartment coarse-coal distributing conveyor, while 2-in.x½-mm. material is run to one compartment of the fine-coal distributing conveyor. With this arrangement, the fine-coal conveyor can carry minus 2 in. in one compartment and one of the following sizes in the other: ¾x¼-in. stoker, ¾-in. screenings, or ¼-in.x½-mm. screenings. In other words, the two distributing conveyors take four sizes to the storage plant: 7x4-in. egg, 4x2-in. nut, 2-in. screenings, and ¾-in. screenings or ¾x¼-in. stoker. When making stoker, the resultant ¼-in.x½-mm. coal joins the 2-in. screenings.

The 1,700-ton storage and truck-loading plant is separated from the washing and screening plant by an interval of 92½ ft., which is sufficient for the future installation of four loading tracks and one runaround track for rail shipments if the prospects for this business should warrant. One section of this plant with a capacity of 900 tons serves largely as a source of 1¼-in. screenings for the Solarite plant, although seven truck-loading chutes permit commercial sales.

Six Storage Bins

On the opposite side, the storage plant is split up into six separate bins holding: 7x4-egg, 4x2-in. nut, 7x2-in. egg, ¾x0-in. screenings, ¾x¼-in. stoker, and 2-in. degradation from the egg and nut loading equipment. The 7x2-in. bins normally take care of an overflow of 7x4 or 4x2, or both, the sizes being mixed to make the 7x2 product.

Coal, as noted above, is brought to the storage plant by the two two-compartment distributing conveyors. Gates in the bottoms of the conveyors route the coal to the proper bins. Egg, nut and 7x2, eased into the bins by spiral lowering chutes, are loaded into trucks through chutes preceded by Jeffrey-Traylor screens for removing degradation. One chute and degradation screen each are installed for egg and nut, with two screens and chutes for 7x2. Degradation (—2 in.) falls into a scraper conveyor which discharges into an elevator leading up to the small degradation bin. This degradation normally is sent to the Solarite plant. Other sizes are loaded through chutes without degradation screens.



Picking of lump is done on an extension of the mine-run shaker. Unless lump is called for, it then drops through the gate en route to the crusher and washer.

The one 900-ton bin receives only 1¼-in. screenings because minus 2-in. coal brought from the main plant, as described above, is run through a McNally-Pittsburg stoker-coal sizer before it is deposited in the bin. A cross conveyor brings the coal over to the sizer, and this cross conveyor can receive any other size brought to the storage plant for crushing. Bottoms of the bins in the storage plant are inclosed to keep in heat and prevent freezing in winter.

Fresh water for the operation of the plant is collected in a 24-acre artificial lake. From this lake a 6x4 Fairbanks-Morse centrifugal pump forces make-up water to sprays over the classifying and dewatering screens. With the nozzles in service, make-up should total 300 g.p.m. Excess water from the settling tank flows into a settling pond; overflow from this pond is returned to the main lake.

A chemical laboratory, in charge of M. Burns, and a truck-weighing and billing station accompany the Millstadt preparation plant, which is operated by 32 motors (mostly Wagner) totaling 875 hp., exclusive of a few fractional-horsepower units. Operating voltage is 220, with current supplied by a separate transformer station serving only the preparation plant. General Electric magnetic starters are used, and each is preceded by a "No-Fuse" breaker. "No-Fuse" breakers also are used in all lighting circuits. All wiring is installed in conduit. Power-transmission equipment includes Falk "Motoreducers," some with finished roller chains, and V-belts. Heating is done with a low-pressure steam boiler and unit heaters, also coal-type stoves filled with brick and equipped with gas burners using gas from the Solarite plant.

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Setting the Record Straight

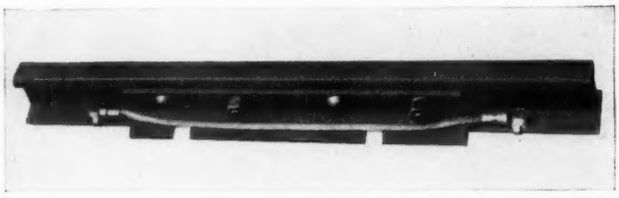
IN DESCRIBING the new Armco barge-loading plant at Huntington, W. Va. (*Coal Age*, May, 1940, p. 37), mention was made of the savings effected in transportation costs. Comment since publication, however, reveals that the phraseology used in this connection created an unintentionally exaggerated impression of these savings—due apparently to the wording of the title and a typographical error in one of the opening paragraphs.

The title stated that the new plant "cuts coal-moving costs 87c." This should have read "rail-moving costs." As explained in the body of the story, when coal was moved all-rail the freight rate was $2.12 per ton. The two rail rates in the present rail-river-and-rail combination total $1.25 per ton. In addition, of course, rail and terminal costs, including return on the investment in the Huntington plant, must be paid. To quote the article: "The margin available for terminal and river costs *and savings*, therefore, is 87c." The sentence immediately preceding, which stated that the $1.25 rate covered both rail and river hauls, was erroneous.

Coal Age regrets the impression created by these contradictory statements and takes this means of setting the record straight.

WELDERS AGREE ON THE BF-3

A power bond designed by Welders for Welders



TYPE BF-3

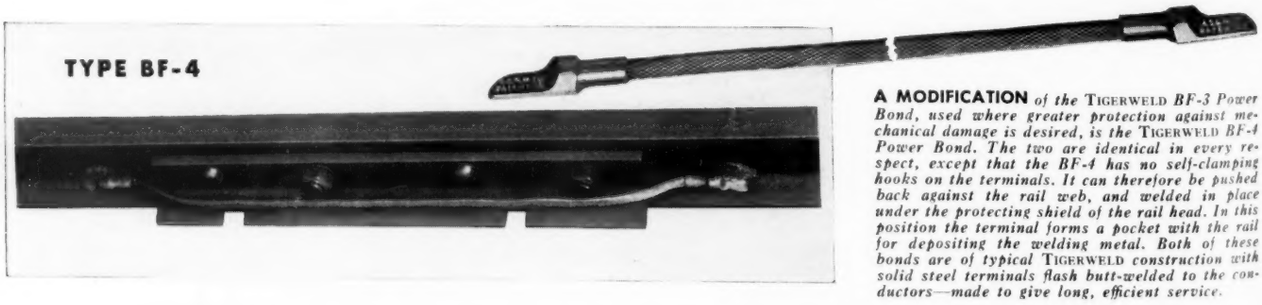
WELDERS told us what they wanted — a power bond that would install easily and quickly, one that would require no special skill to produce effective, trouble-free bonding.

And so the TIGERWELD BF-3 was designed, to simplify in every possible way the job of welding it to the rail.

This bond's terminal is formed into a sloping surface, at just the right angle for easy welding. No clamps are required to hold it in position. Self-clamping hooks are provided on the terminals. You merely tap the terminal on the rail base with a hammer, and there it stays, tight and steady until the weld is finished.

Welders helped design this bond—that's why welders everywhere prefer it. If you aren't already using the BF-3 to complete your power circuits, give it a try. And then, don't take our word for it—ask the welders. They'll tell you it helps them turn in a better bonding job in less time than ever before.

TYPE BF-4



A MODIFICATION *of the* TIGERWELD *BF-3 Power Bond, used where greater protection against mechanical damage is desired, is the* TIGERWELD *BF-4 Power Bond. The two are identical in every respect, except that the BF-4 has no self-clamping hooks on the terminals. It can therefore be pushed back against the rail web, and welded in place under the protecting shield of the rail head. In this position the terminal forms a pocket with the rail for depositing the welding metal. Both of these bonds are of typical* TIGERWELD *construction with solid steel terminals flash butt-welded to the conductors—made to give long, efficient service.*

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UNITED STATES STEEL

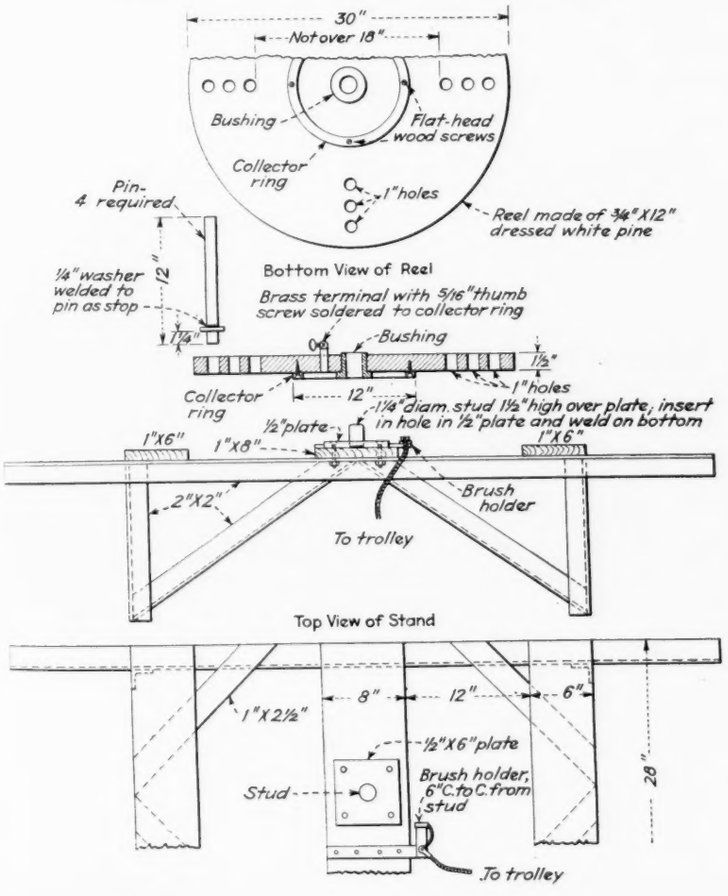
WHAT'S NEW IN OPERATING IDEAS

Installing Locomotive Cables Facilitated by Special Reel

To facilitate the installation of new cables on gathering locomotives and eliminate the necessity for unrolling them or running them on from the center of the coil, with resultant twisting and shortening of cable life one to three months, E. C. Hitchcock, electrician, New River Co., Summerlee, W. Va., offers the reel shown in the accompanying illustration. Cheapness, easy construction, light weight and simple operation are advantages noted by Mr. Hitchcock. The reel shown accommodates a 333⅓-ft. roll of cable, either rubber-covered or braided, and rests on a rack, or stand, provided with a stud and bearing plate. The stud fits in a bushing in the reel, the shoulder on the bushing acting as a thrust bearing. Power for the reeling operation is supplied by a collector ring and cable terminal on the reel and a small vertical brush holder on the stand (see illustration), from which a cable is carried to the trolley or other source of power. Four pins are provided to hold the cable on the reel.

To use the reel, the old cable first is taken off the gathering locomotive and then the portable reel and stand is set against the locomotive bumper. The factory wrapping is taken off the new cable, which most companies buy in 333⅓-ft. lengths, and the roll is laid on the reel. Then the outside end of the cable is connected to the locomotive reel and the inside end to the terminal on the portable reel, after which the four pins are put in the reel holes to hold the new cable in place. Next, the lead from the brush holder on the reel stand is connected to the trolley wire and the reel switch on the locomotive is closed. Power to operate the locomotive reel therefore is supplied through the new cable itself, and the locomotive reel will pick up the cable of its own accord. The result is that the new cable is reeled onto the locomotive just the opposite of the way it originally was rolled up by the manufacturer, thus avoiding twisting and kinking. The operation takes from 5 to 8 minutes. By allowing the cable to slip through the hands as it is reeled onto the locomotive, sufficient braking action is afforded to prevent the cable from piling up on the locomotive reel.

Details of reel for installing new cable on locomotives



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Hydraulic Press and Die Used to Make Bonds

Reading about the bonds used at Gatliff, Ky. (*Coal Age*, March, 1940, p. 66), prompts Thomas James, mine manager, American No. 2 mine, Knox Consolidated Coal Corporation, Bicknell, Ind., to submit a description of bond manufacture by means of a hydraulic press. Such a bond is shown in the accompanying illustration. The materials consist of scrap copper (trolley wire, stranded feeder, cable, etc.) and ⅜-in. galvanized pipe. A length of pipe is slipped over the end of the cable and then, using a die to get the proper shape (roughly half oval), is subjected to a pressure of about 50 tons in a hydraulic press.

Bond terminal of galvanized pipe put on a hydraulic press.

"Before we had the press," says Mr. James, "we made the bonds with a hand hammer and die—sometimes only the hammer. However, the press makes a better and cheaper bond. All bonds used at the two American mines at present are homemade, and, as we have experimented over two years, are using them still. I think they are satisfactory. A man will make between 100 and 150 of these bonds in a shift of seven hours."

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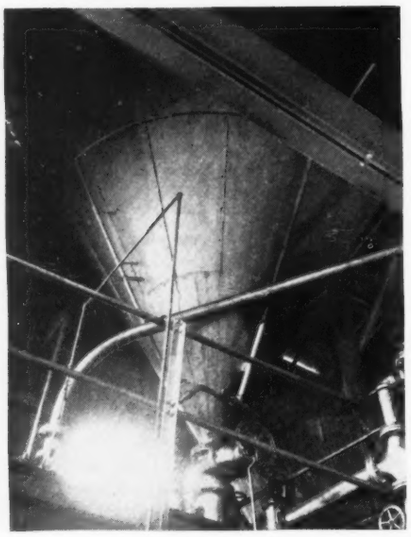
Fines Broken Up in Cone By New Pressure Inlets

Difficulty in breaking up the fines in the secondary settling cone after a shutdown at the new Castle Gate (Utah) preparation plant of the Utah Fuel Co. has been solved



Bottom of the secondary settling cone at Castle Gate, showing one set of auxiliary pressure inlets, together with header pipe and control valve.

by additional inlets for pressure water in the sides of the cone. The arrangement of these openings is shown in the accompanying illustration. Two sets of inlets, each with its own header and control valve, have been installed, with a main header connected to the fresh-water system supplying a pressure of 100 lb. per square inch. No trouble has been encountered in starting the cone since the auxiliary inlets were installed.

•

Block-Signal Switch Built From Locomotive Parts

Many operators of mine haulage systems that consist of several trains and but a single-track main line are often troubled with traffic-congestion problems and occasionally rear- or head-end collisions.

Since the rather temporary nature of these systems, coupled with unusually severe underground conditions, precludes the installation of the conventional surface type of electric block signals, some compromise must be effected.

After much experimenting with various types of automatic mechanical and electrically operated block-signal systems to control trip operation in one large mine, these were eventually discarded for a simple and sturdy electrical device operated by the motormen as they enter or leave the main line," states Paul C. Ziemke, Milwaukee, Wis. "Our early experiments with the conventional ceiling-mounted pull, or "pendant," switch soon demonstrated the need for a far more sturdy and dependable unit, although we used the best the market offered. Therefore, a heavy-duty three-way switch was constructed from mine-locomotive repair parts—usually available at every well-regulated mine warehouse.

"The parts were selected as follows: one wood reverse drum, one cast-iron "star" wheel, three contact fingers; one ½-in. cold rolled shaft; one set of copper segments, one roller-and-spring assembly and one finger mounting block. The segments were arranged on the drum (see diagram) to function as a three-way switch with the contact fingers arranged in a row of three on the mounting block. The star wheel was keyed to the ½-in. shaft with the notches aligning with the drum segments. The opposite end of the shaft mounted a 7-in. notched gear wheel, salvaged from junk, which was actuated by a spring-equipped pawl mounted on an operating arm. Attached to the outer end of the arm was a short section of light cable terminating in a wooden hand grip. This arm, when moved downward by the action of the motorman's hand, was restored to the operating position by a coil spring mounted directly above it. These assemblies were mounted in well-constructed wood boxes mounted at turnouts.

"As a motorman came out of any side entry, he was informed of a trip on the main line ahead of him by a red lamp. If, on the other hand, the line was clear, a green light showed. Moving forward on the green light, he pulled the cable lightly as he passed under the signal switch, thereby changing the green light to red and protecting his trip until his return. Then, on reentering the side entry, he cleared the signal by a second pull on the cable and reestablished the green light for other trips.

Where curves in the main line interfered with the view of the signal lamps, extensions were wired around the obstruction.

"This type of switch will render long years of dependable service under severe conditions and may be readily adapted to a variety of uses along a mine haulage system. By the simple expedient of adding segments and contact fingers, as an example, it serves as a four-way switch where conditions warrant. Power, of course, is taken directly off the trolley circuit and fed through a 5-amp. plug fuse into the switch and lamps. For trouble-free service it is recommended that No. 14 stranded wire with live-rubber insulation (latex) be tied to porcelain insulators. This material has twice the life of ordinary insulation and the ties prevent cutting the insulation by the sharp edges of ordinary "Nail It" knobs."

Details of signal switch; also method of installing indicating lights.

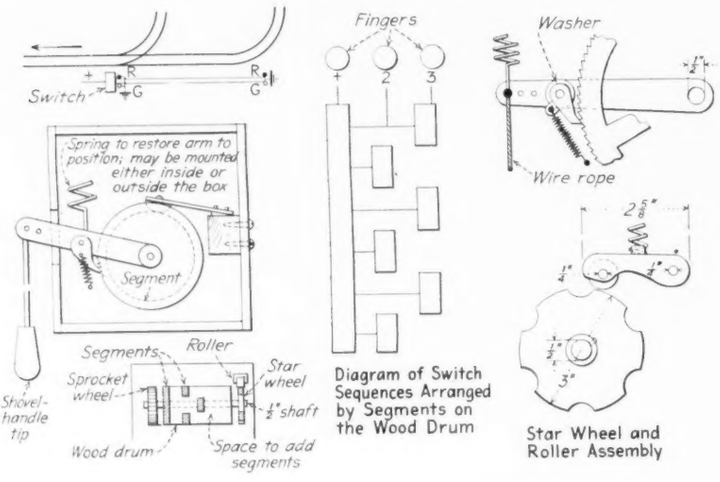


Diagram of Switch Sequences Arranged by Segments on the Wood Drum

Star Wheel and Roller Assembly

No Muffs

Muffing a ball costs a player an error in baseball, while muffing an opportunity around a coal mine runs up the production cost. Therefore, operating, mechanical, electrical and safety men should be there with the answer when trouble rears its head. Experience is one way of finding the answers and this department is designed to present the combined experience of coal-mining men all over the country. So if you have a money-saving or safety-promoting kink, or any new idea for improving mine operation, here is the place for it. Send it in, with a sketch or photo if it will help to make it clearer. For each acceptable idea, Coal Age pays $5 or more on publication.

•

Thought in Trestle Design Cuts Cost Over the Years

In constructing a trestle across Jones Fork for the transportation of coal from Mine No. 4 to the tipple at Mine No. 7, considerable thought was given to design to insure economy and efficiency, declares E. A. Smith, chief engineer, Central Elkhorn Coal Co., Estill, Ky. Made for only one track, the deck width therefore was only 10 ft. Trestle length was 865 ft. and the average height to the caps was 24 ft. over a distance of 600 ft.

Long-leaf yellow pine was used throughout for long life. All small pieces, such as 3x8's, were ordered surfaced on four sides to retard penetration of moisture and resultant fungus growth and decay. This 3x8-in. material was used as flooring on 9-in. centers, thus leaving a 1-in.-wide opening between planks to shed moisture and prevent the accumulation of débris. The 3x8's also were used for cross-bracing, and the trestle in general was well supported (braced longitudinally) between two hills.

Sizing the caps to 9¾ in. at the posts was a material advantage in framing, and sizing of stringers to 13 in. at the bearing points facilitated making good joints. The 28-ft. double-span stringers made a stronger struc-

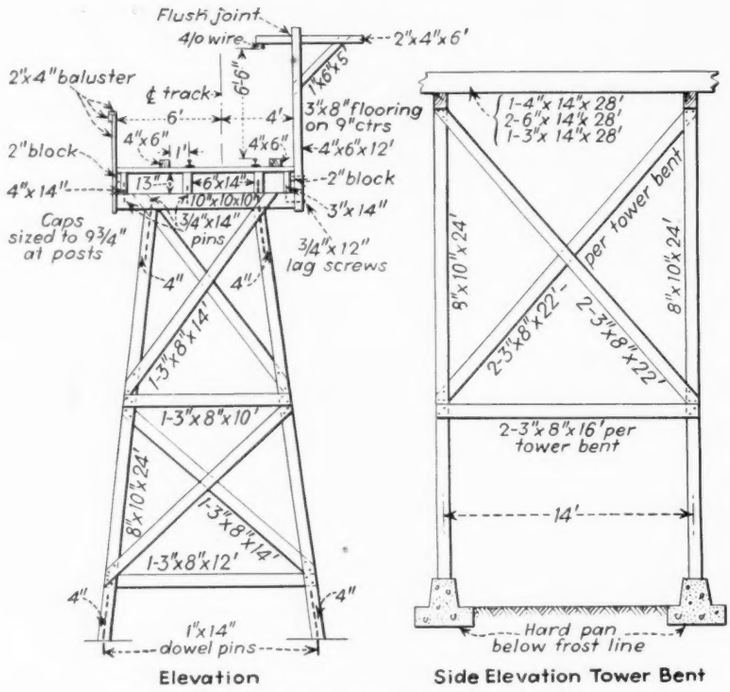
A fire or explosion in a mine can cost so much in life and property that safety must come before everything else. Storage battery propelled haulage equipment is known to be the safest that can be used.

When powered by Exide-Ironclad Batteries, such equipment not only insures utmost safety, but it helps to keep down costs. Exide-Ironclads, with their high power ability and sustained voltage, provide increased production per day by speeding up the haulage service and handling greater tonnage.

In the gasiest mines, under the most dangerous conditions, Exide-Ironclads are widely used both in mine locomotives and rubber-tired haulage equipment. Such equipment propelled by Exide-Ironclad Batteries bears the approval of the Bureau of Mines. It is true that no price is too high for safety . . . but because of their performance and long life, Exide-Ironclad Batteries enable you to enjoy far greater safety without a corresponding increase in cost. Write for new, free booklet, "Mine Haulage on Rubber Tires."

Exide
IRONCLAD
BATTERIES
With Exide MIPOR Separators
"MIPOR," Reg. U. S. Pat. Off.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto



Details of trestle construction.

ture than would have been the case with single-span timbers. Ends were alternated to advantage. The 4x6-in. railing was placed 1 ft. from the gage line of the track as a safety precaution in case of derailments. And the wide footers were placed on hardpan or subsoil below the frost line.

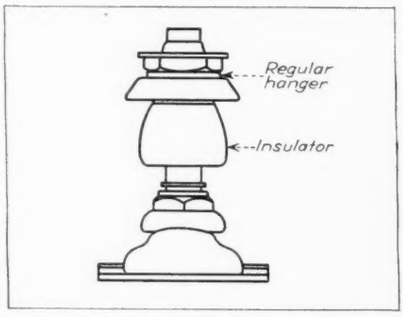
"The tower-bent feature seems unique within itself, for such bents were built independently except for contact by ground or stringer. A third member, or post, was suggested. This, however, would have cost 50 per cent more for footers, dowel pins, timber and labor than two-post construction."

•

Spool Insulator Eliminates Danger of Flashovers

Ordinarily it should be just as simple to suspend and insulate a mine trolley wire from steel I-beams and pipe construction as it is from wood structures or dry roof, states *O-B Haulage Ways*. "However, insulated mine hangers installed on steel beams or pipe occasionally are destroyed by a flashover from the boss of the trolley wire clamp to the metal shell, or skirt, of the hanger body." Investigation shows that in these cases the overhead structure was directly or partially grounded to the rail or return circuit.

"When, for increased safety, supporting structures are grounded by bonding to the rail or are accidentally grounded through contact with armored cables, water pipes and similar objects, the insulated hanger shells also are grounded. This condition causes the full potential of the trolley circuit to be impressed across the short air space between the boss of the clamp and the skirt, or shell, of the hanger. If the insulated surface of the hanger is reasonably clean, so that there is no leakage across it, any standard mine hanger will provide sufficient trolley-wire insulation. However, the condition is potentially dangerous because the spark of a passing current collector may de-ionize the surrounding air, break down its resistance to flashover and consequently allow an arc to jump from the clamp to the hanger. Because of the tremendous impressed voltage behind such an arc it is almost certain to burn up the hanger unless protected with circuit breakers or other short-circuit equipment."



Trolley-wire hanger equipped with spool insulator.

In many cases it is impossible to eliminate grounded structures. But it is quite simple to prevent the possibility of flashovers by the insertion of supplementary insulation which will increase the resistance between the trolley wire and the grounded structure. At many mines, thin mica or insulating fiber is installed between I-beam clamps and the I-beams. When pipe construction is used, it is common practice to wrap the mica around the pipe at the point where the hanger is attached. An ordinary hanger added to the standard assembly of hanger and clamp will also do the trick by increasing the air space between the clamp and the grounded member. "The practical and foolproof method" is to insert an insulator or spool between the hanger and trolley-wire clamp. Many mines standardize on this type of secondary protection.

"Why not make a mine hanger large enough to provide for this condition? is a question often asked. This could be done, of course, but it would be necessary to make such a hanger at least 6 in. in diameter," which would be quite costly in comparison to the suggested methods.

•

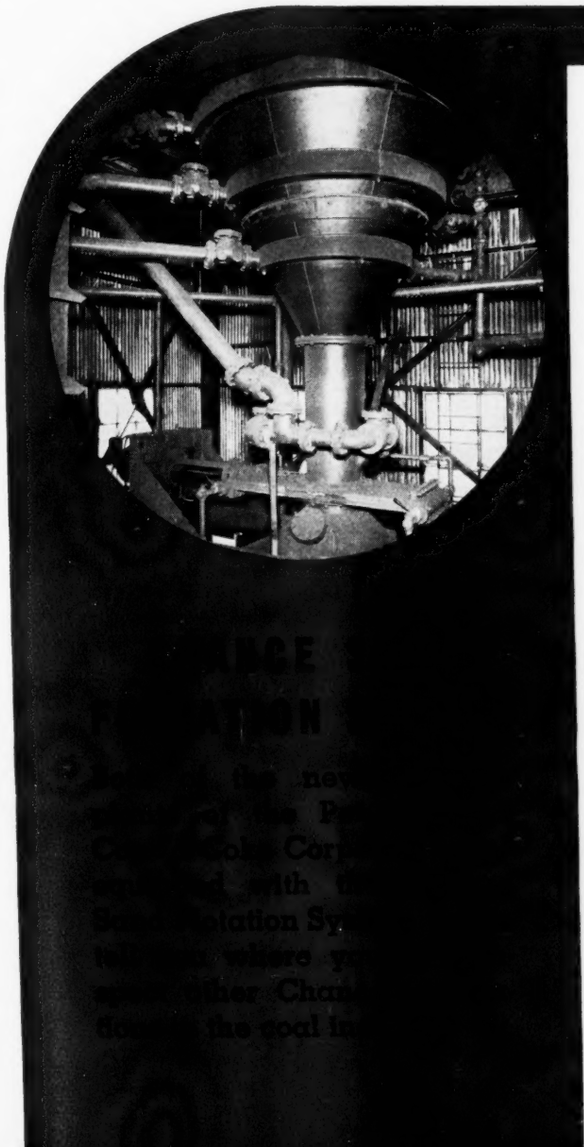
Skid With Hinged Horn Stops Car Two Ways

Cars at the Cadogan (Pa.) mine of the Allegheny River Mining Co. are not equipped with brakes, and instead of using sprags it has been the practice to employ the common shoe, or skid, under the wheels to hold them motionless and also to provide a braking effect on grades. It also has been the practice, states James Thompson, superintendent, to use the skids under the wheel of the first car in trips being slowly moved past conveyor-loading points by hoists. The idea is that the shoe immediately stops the trip when the hoist is shut off.

Some very rolling coal recently was encountered in the conveyor sections, however, and while the shoes prevented trips from rolling forward they did not stop them from drifting back. This made it necessary to devise a shoe which would prevent motion in either direction, which was done

Three steps in applying the skid with extra hinged horn to hold the trip against movement in either direction.

ONE GOOD TURN DESERVED ANOTHER



TRADE MARK REGISTERED.
FAIRMONT

Shown above is the new Fairmont-built Chance System cleaning plant serving Moss Creek Mine 21 and 22 of the Pennsylvania Coal & Coke Corporation—and thereby hangs a tale:

> *Based solely on the fine performance of the plant, this same company awarded Fairmont a contract for the design and construction of a second washery to be installed at their No. 3 Mine at Ehrenfeld, Pa.*

Fairmont preparation plant service to the coal industry is complete in every respect—design, engineering and construction. Both the Chance Sand Flotation System (for wet cleaning) and the American Pneumatic Separator System are available (for dry cleaning).

Consult Fairmont Engineers with regard to your coal cleaning problems.

TRADE MARK REGISTERED
FAIRMONT MACHINERY COMPANY
FAIRMONT, W. VA.

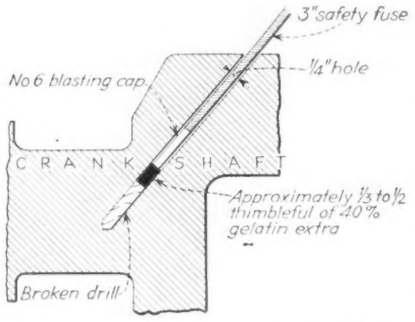
by C. E. Morris, chief electrician. The new shoe is equipped with a hinged horn that can be dropped down to permit the wheel to run up on the skid. Then the horn is raised to block the wheel on that side, as shown in the accompanying illustrations.

The hinge is designed so that when the horn is dropped it offers no obstruction to the passage of the wheel. Also, the horn does not tend to drop out of locking position. Naturally, it prevents movement of the trip in either direction. The cost is very small and a thorough trial has shown the practicability of the idea. A handle is built in a safe place in the front horn, which is welded to the skid proper.

•

Broken Drill Bits Extracted With Charges of Dynamite

Years ago, dynamite was used to blast axle stubs from wheels in railroad-equipment scrapping operations, O. J. Otto, of Nash-Kelvinator Corporation, Racine, Wis., points out in the *Explosives Engineer.* A modified application of this process has been developed for blasting broken drill bits from the small oil holes in automobile crankshafts at the Nash-Kelvinator plant. The removal of



Dynamite in place over broken drill bit.

these broken bits, which are snapped off anywhere from the collar of the hole to a point down inside, is accomplished with small charges of dynamite. The technique of the operation has been successfully developed and scrap loss of crankshafts due to broken drill bills is eliminated.

To remove a broken bit, the crankshaft first is clamped in a support on a table over which a metal hood can be lowered. Loose chips are carefully removed from the hole by jarring or by using a jet of compressed air. A very small charge (one-third to one-half thimbleful of 40-per-cent ammonia gelatin) is placed in the hole over the broken bit. The charge is primed with a No. 6 cap, and during firing the hood is lowered to confine any flying particles. Electric blasting caps are fired from a safety switch. Other type caps are fitted with a length of fuse and safety-fuse lighter. "After the charge has been fired the crankshaft is turned over, so that the open end of the hole is down, and the crankpin is tapped with a hammer. If the drill fails to fall out, the operation is repeated. The blow from the dynamite usually is sufficient to loosen the bit, and it should fall out of the hole of its own accord.

"The method of charging varies with location of the broken drill. Experience showed that when a drill has broken off close to the collar of a hole, the charged end of the cap just seats in the hole and the explosion will flare the collar. In such cases the cap is inserted above the hole in a mound of plastic clay built up around the collar. In cases where the drill has broken off flush with the collar, both charge and cap are placed outside the hole over the bit and held in place with clay." After a bit is dislodged, the hole should be thoroughly cleaned to remove any unexploded powder. Then it is drilled a slight amount with a portable drill to make certain the hole can be finished on a machine.

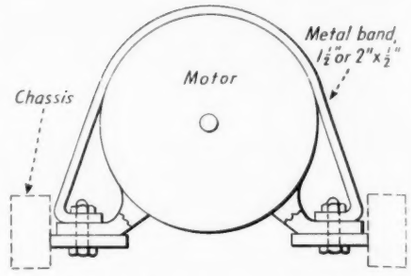
With a crankpin, the shaft is clamped in a special device which reinforces the metal against shock of the explosion. "All safety precautions which apply to dynamite and caps are observed, with special emphasis on keeping explosives away from metal tools." The blasting is performed only by men thoroughly experienced with the method and who fully understand safety precautions necessary in the use of explosives.

"FFF black powder and several strengths of dynamite and gelatin have been tried and it was found that 40 per cent ammonia gelatin was the most effective. The dynamiting procedure has been intensively investigated by automotive engineers with reference to any damage of the grain structure and other specifications of the crankshaft steel. Exhaustive tests carried out by the laboratories on crankshafts which had been blasted failed to show anything detrimental. Where it is possible to remove a broken bit with one or two shots, caliper measurements have failed to show any enlargement of the hole."

•

Metal Band Holds Driving Motor To Loading-Machine Frame

Most Joy 5-BU loading machines, due to various causes, have had from one to all four feet broken off the driving motor, states Thomas James, mine manager, American No. 2 mine, Knox Consolidated Coal Corporation, Bicknell, Ind. These are repaired by being welded on again, but they soon break again. As it is quite a job to take out a motor and weld the feet on, a method of repair has been adopted that stops the trouble.



Metal band holds motor to frame of loading machine.

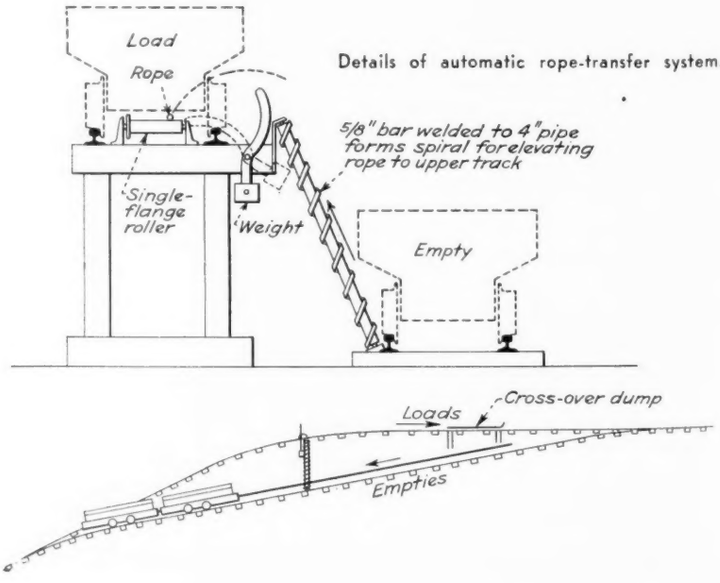
After the broken feet are welded and the motor is replaced in the frame, a U-shaped metal band is put around the motor as shown in the sketch. The ends of the band are placed under the nuts which hold the motor to the chassis. This is a simple and effective method of overcoming the difficulty.

The tendency of the motor, when running, is to work up and thus throw the pinion out of mesh. With the band, even if the feet should break again (which is unlikely), there can be no damage to the gears because the motor cannot raise up out of position.

•

Spiral and Arm Transfer Rope From Track to Track

In transferring the rope from the empty to the loaded track at the slope knuckle, the Zenith Coal Co., Grant, Tenn., uses a spiral and weighted arm, as indicated in the accompanying sketch, submitted by A. W. Evans, Petros, Tenn. As the empty trip descends, the rope strikes the spiral and is raised to the level of the loaded track. Leaving the top of the spiral, the rope strikes the weighted arm and causes it to swing down to form a track on which the rope can slide over the loaded roller ready for the next hoist. To facilitate the transfer, the flange is removed from one end of the roller. When the rope lands on the loaded roller, the weight on the arm causes it to fly back to normal position ready for the next descent of the empties.



Details of automatic rope-transfer system.

WHAT'S NEW IN THE FIELD

Urges City Coal Fund for Public If Dealers Cannot Deliver

James L. Ford, Jr., chairman of the St. Louis Municipal Smoke Elimination Committee, said he considered it imperative that the Board of Aldermen approve, before adjourning for the summer, a pending bill to appropriate $300,000 as a revolving fund to enable the city to buy smokeless fuel for sale to the public in the event that coal dealers fail to provide it. He said immediate passage was "absolutely essential in order to avoid a coal famine in the winter." Action next autumn would be too late, he explained, because coal must be shipped into the city in the summer. He added that he did not know that the fund actually would be used, but said it should be available if needed.

The Frisco road filed late in May a multiple-car rate of $2 a ton on coal moving from Arkansas mines to St. Louis. The rate, intended to become effective June 24, is applicable only on coal loaded to not less than 50 tons per car when in lots of 2,000 tons, concentrated at Fort Smith and shipped therefrom in one day from one shipper to one consignee on one bill of lading.

A protest against the proposed rate was filed with the Interstate Commerce Commission on June 10 by a committee representing Eastern railways. The rate went into effect, however, as the I.C.C. declined to suspend it, an announcement on June 22 said. The Illinois Mining Institute also circularized its membership urging the filing of protests with Mayor Dickmann that the smoke ordinance "is a hurried, untimely, and drastic prohibition against Illinois coal, which will postpone rather than hasten the ultimate processing of Illinois coal by seriously crippling the coal industry of Illinois, which is trying to cooperate with the city of St. Louis."

•

New Preparation Facilities

AYRSHIRE PATOKA COLLIERIES CORPORATION, Staunton (Ind.) Mine: Contract placed with McNally-Pittsburg Mfg. Corporation for a 400-t.p.h. washing plant using two McNally-Norton automatic washers, one of which will be a compound washer; all coal to be broken to minus 6 in. before washing; then classified into four sizes with blending and mixing facilities; ⅜-in. x 0 coal to be dried in improved Elmore centrifugal dryer; to be completed about Oct. 15.

GREEN TOP COAL CO., Giombetti breaker, Jessup, Pa.: Contract closed with Finch Mfg. Co. for one 3-ft. Menzies cone separator to clean buckwheat, rice and barley coal; feed capacity, 12 tons per hour; completed.

ROY RISSER, INC., Risser Breaker, Beaver Brook, Pa.: Contract closed with Finch Mfg. Co. for one 6-ft. Menzies cone separator for cleaning stove, chestnut, pea and buckwheat coal; feed capacity, 40 tons per hour; also one 3-ft. Menzies cone separator for cleaning rice and barley; feed capacity, 12 tons per hour; to be completed about Aug. 1.

STANDARD COAL CO., new mine near Princeton, Ind.: Contract closed with Templeton-Matthews Corporation for new preparation plant and slope conveyor designed to handle 400 t.p.h. of mine-run coal with facilities for screening, crushing, washing and loading 7-in. x 0 coal, which will be washed in a five-cell 7-ft. Jeffrey air-operated jig; minus ¼-in. coal, after washing, will be dried in an Elmore centrifugal dryer; after washing, the coal will be sized into 7 x 4-, 4 x 2-, 2 x 1¼-, 1¼ x ¼- and ¼ x 0-in. for loading on four tracks.

•

Bootleg Control Gets Setback

Efforts to curb the sale of "bootleg" anthracite in New Jersey received a setback when a three-judge Federal court, at Camden, on May 27 declared unconstitutional the act requiring truckers to have certificates showing the origin and destination of their coal. Morris Marshall, secretary of the South Jersey Retail Coal Merchants' Association, said that an appeal would be taken to the State Supreme Court or the United States Supreme Court, if necessary, to protect retailers against the illegitimate traffic.

Keeping Step With Coal Demand

Bituminous Coal Stocks

	(Thousands of Net Tons)		
	May 1 1940	Apr. 1 1940*	May 1 1939
Electric power utilities	9,514	9,257	7,642
Byproduct coke ovens	5,150	5,305	4,434
Steel and rolling mills	565	578	803
Railroads (Class 1)	4,546	4,660	6,387
Other industrials†	10,765	10,408	8,960
Total	30,540	30,208	28,226

Bituminous Coal Consumption

	(Thousands of Net Tons)		
	April 1940	March 1940*	April 1939
Electric power utilities	3,651	4,029	2,827
Byproduct coke ovens	5,632	5,830	4,114
Steel and rolling mills	725	870	823
Railroads (Class 1)	6,724	7,288	6,042
Other industrials†	9,434	10,521	8,584
Total	26,076	28,538	22,390

* Revised. † Includes beehive ovens, coal-gas retorts and cement mills.

Stoker Men's Turnout Stresses Comfort as Well as Thrift

Striking a keynote of confident optimism in the face of a year of ominous events, E. C. Sammons, retiring president and chairman of the executive committee, in his report at the 23d annual meeting of the Stoker Manufacturers' Association, Homestead Hotel, Hot Springs, Va., June 6-7, emphasized the steady increase in stoker sales the past few years with a 16-per-cent gain in unit sales for the first quarter of 1940 over the same period last year. Pointing out the effective cooperative advertising in many cities and the excellent assistance of the coal industry through its promotion of the phrase "It's healthy to be comfortable and smart to keep warm at low cost," he urged the industry not to overlook the fundamental virtues of the stoker by concentrating too strongly on the "economy" sales point.

"Many coal producers," continued Mr. Sammons, "feel that most stoker manufacturers are merely coasting along and are not making an adequate effort to improve the performances of their equipment on a wider variety of coals. They have been wanting a fully automatic stoker to compete with oil and gas, particularly in the new home market. Some of the manufacturers have brought out new combination furnace units and boiler units as one of the steps in that direction.

"It behooves us, as stoker manufacturers and as a close ally of the coal industry as well as business men, to give serious consideration to development and design of equipment that will eventually meet the requirements as outlined above. Private initiative and the enterprising young men whom we have employed in our industry as engineers and technicians will bring these developments about. We of management have a stake in the future of our industry, and research is one of the specific things which we must continue to do in order to keep abreast of the times and provide equipment that meets the exacting requirements of the consumer and prospect."

Close to a hundred were present at the two-day meeting, with stoker sales executives predominating. A clinic on merchandising was conducted by Carl Palmen, merchandising counsellor, Cleveland, Ohio. This clinic was built around the sales problems of domestic ice manufacturers, who have overcome considerable sales resistance by undertaking the sale of improved ice boxes and have thus created customers for their ice. In answer to a question as to how far the coal operator should go in furthering the sale of stokers, Mr. Palmen replied "the coal producer had better take part in the merchandising of equipment which in-

trigues the buying public. He should join in a definite program which involves the retail dealer, the stoker manufacturer and the coal producer."

It also was announced that the association had completed its standardization work on minimum setting heights and stoker ratings and that the engineering committee was undertaking studies on other phases of standardization that would be reported on at the winter meeting of the association.

Officers elected for the ensuing year were: president, Frank Hoke, Indianapolis, Ind.; vice-president, B. O. Fink, Auburn, Ind.; and treasurer, John Munro, Harvey, Ill. These three officers together with E. C. Sammons, of Portland, Ore., and C. E. Lewis, of Rochester, N. Y., comprise the new executive committee. Marc G. Bluth, Chicago, was reappointed secretary.

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Seek Maritime Commission Ships For Trade and Transport

In an effort to pry loose the laid-up overage fleet of cargo ships of the U. S. Maritime Commission and get them reconditioned and back into service without delay, a group of railroad officials and coal exporters accompanied by Representative S. O. Bland of Virginia, chairman of the House Merchant Marine Committee, and Representative John Kee, West Virginia, conferred on June 5 with Admiral Land, chairman of the U. S. Maritime Commission, and his associates. They sought to enlist the Commission's support of the move to obtain a deficiency appropriation of $10,000,000 to recondition the 100 cargo vessels now owned by the Commission. This is in line with the bill passed by Congress and approved by the President in May conferring upon the Maritime Commission the requisite authority to restore the fleet to service.

Among the delegation were: E. D. Ennoy, Consolidation Coal Co.; A. L. Lynn, Island Creek Coal Sales Co.; F. F. Estes, National Coal Association, and Anna C. Van Sickler, Coal Exporters' Association of the United States. Others who have been active in seeking to obtain action along these lines include Senator Neely of West Virginia, Senator Guffey of Pennsylvania and Representative John M. Robsion of Kentucky.

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Short Coal Course Started

A short coal course for coal-mine employees was instituted on June 17 at the State Teachers' College building, Frostburg, Md. The studies include intensive training in mine gases, mine haulage, mining arithmetic, electricity applied to coal mining, map reading, methods of working, first aid and rescue.

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Newcoal to Rebuild

Work was to begin within a few days on rebuilding of an engine and generator house for the Newcoal Corporation, Madisonville, Ky., officials of the company announced on June 4. Reconstruction of the plant, which was destroyed by fire on May 12, is expected to be completed by Sept. 1, when operations will be resumed.

Safety, Mechanical Mining and New Deal Acts Star at Rocky Mountain Institute Meeting

SAFETY, mechanical mining and preparation, and the impact of New Deal legislation on management policies and operating costs held the stage at the 38th regular meeting of the Rocky Mountain Coal Mining Institute, Cosmopolitan Hotel, Denver, Colo., June 6-8. Increased markets for low-rank coals of the Eastern Slope through sharp reduction in moisture content was visualized in a preview of a technical report to be published by the U. S. Bureau of Mines. Election of officers recommended by the committee on nominations at the closing session resulted in the following selections:

President: C. M. Shott, general superintendent, Sheridan-Wyoming Coal Co., Monarch, Wyo.

Vice-presidents: George B. Dick, Gordon Coal Co., Walsenburg, Colo.; Herbert C. Stacher, Gallup-Southwestern Coal Co., Gallup, N. M.; George Jackson, Independent Coal & Coke Co., Kenilworth, Utah; John Wilson, Union Pacific Coal Co., Rock Springs, Wyo.

Executive Board: T. E. Jenkins, National Fuel Co., Denver, Colo.; Fred Nesbit, Hayden Coal Co., Denver, Colo.; H. A. Manda, Defiance Coal Co., Albuquerque, N. M.; L. C. White, St. Louis, Rocky Mountain & Pacific Co., Raton, N. M.; Carl Westerburg, Utah Fuel Co., Salt Lake City, Utah; George Schultz, Liberty Fuel Co., Latuda, Utah; Edward Sawley, Diamond Coal & Coke Co., Diamondville, Wyo.; R. P. Hogan, Colony Coal Co., Rock Springs, Wyo.

Secretary-Treasurer: Fred W. Whiteside, Denver, Colo.

A Safety Program for Colorado

1. All mine officials and prospective officials should take the U. S. Bureau of Mines accident-prevention course.
2. Organize a local chapter of the Holmes Safety Association at each mine or mining community with meetings at least once a month to discuss safety and accident-prevention methods.
3. Organize a State council of the association as this is "necessary to assure the success of local chapters."
4. Induce employees to participate in the accident-prevention course.
5. Foster and promote classes in foremanship training.
6. Revive interest in 100 per cent first-aid training for officials and employees, "with a reasonable amount of mine-rescue training in each district."
7. Have coal-company executives put the matter of accident prevention up to their operating officials.

—W. H. Forbes, engineer-in-charge, Denver station, Safety Division, U. S. Bureau of Mines.

The will for safety, declared A. H. Zeilinger, safety engineer, Minnequa plant, Colorado Fuel & Iron Corporation, must come from the top. Improvement in industrial accident records is necessarily a slow process, but the results are cumulative. Great patience must be exercised in developing the safety spirit; it is not something which can be rammed down the men's throats. Safety preparedness demands that the fight against accidents must never let up. Safety work is a challenge to service; those who achieve results in this field are leaving a worth-while heritage to posterity.

Congratulating the industry for reducing the fatality rate per million tons from 6.78 in 1907 to 2.52 in 1939 proved only a prelude to underscoring the fact that the outstanding major disasters of the past few years have occurred at mechanized mines, in a paper by Dan Harrington, chief, health and safety branch, U. S. Bureau of Mines. "I am not in any degree opposing coal-mine mechanization," declared Mr. Harrington's paper, read in his absence by E. H. Denny, Salt Lake City station of the Bureau, but only trying to place the facts before the industry so that something may be done about it.

Is Efficiency a Drawback?

During the past two and one-half years, said Mr. Harrington, 91 per cent of the bituminous fatalities in major disasters have been in highly mechanized mines. Mulga, Keen Mountain, Duvin and Willow Grove were singled out for special mention. While progress has been made in lowering accident rates from other causes, since 1936 the trend in severity in major disasters has been bad. Although mechanized mining accounts for not more than one-third of the bituminous output, it has been responsible for three-quarters of the deaths in recent years.

The implication that all these fatalities were chargeable to mechanical mining was sharply challenged by several speakers. Wyoming with its high percentage of mechanical loading, observed Glenn Knox, superintendent, Gunn-Quealy Coal Co., Quealy, Wyo., has never had a major disaster in mechanized mines, but has had two in the past two years in non-mechanized operations on Federal lands. Most of the accidents, added H. C. Marchant, assistant to the president, Colorado & Utah Coal Co., occur at hand-loading "dog holes." While he did not dispute the accuracy of the Harrington figures, he insisted they were misleading.

It is up to the Bureau of Mines, continued Mr. Marchant, to work out a formula and lay down the basis for comparison of accident statistics in mechanized and non-mechanized mines. Accidents attributable to mechanical operation as such should be segregated from accidents common to both types of mining methods. This position was strongly supported by D. H. Pape, president, Sheridan-Wyoming Coal Co. Mechanical mining, it was pointed out, should contribute to a reduction in accidents from falls, since the total area of

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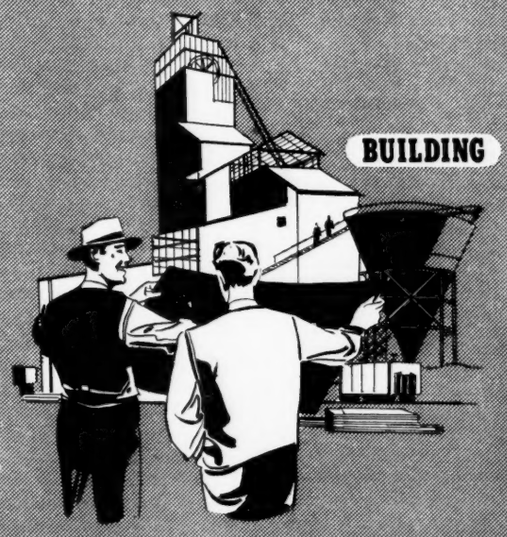

For over 25 years MORROW engineers have been studying, planning, designing, building coal preparation equipment to meet the constantly changing fuel requirements.

During these years of experience Morrow engineers have blueprinted every conceivable coal handling problem! That is why we say, "Morrow knows the Coal Industry." And what is more—*The Coal Industry knows Morrow!* Successful operators know by experience that the Morrow organization is "tops" in advanced engineering design and construction. These operators know that Morrow coal handling equipment can always be depended upon to profitably deliver its fuel tonnage capacity day in and day out, year in and year out.

Whether you contemplate a complete tipple installation or the modernization of your old equipment, Morrow has the answer. Morrow service is complete and comprehensive—designing, planning, building—assuring you the advantages of individual responsibility and the convenience and economy of one negotiation. Put your problem up to Morrow. Their large selection of standardized designs gives you the broadest choice of equipment to meet your requirements in the quickest time.

Morrow engineers are at your service anytime—anywhere!

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DESIGNERS AND BUILDERS OF COAL HANDLING EQUIPMENT FOR OVER 25 YEARS

roof exposed at any one time and the length of exposure is so much less than in hand-loading operations.

If accident costs were budgeted, suggested W. H. Forbes, associate mining engineer, U. S. Bureau of Mines, Denver, management would soon realize these costs were "nothing short of an expenditure of money for a useless, non-productive purpose, accompanied by much tragedy and human suffering." Direct costs of compensation in Colorado last year approximated $706,912, or 12c. per ton. Indirect costs double or quadruple that figure. This would mean the industry had an accident bill of $1,400,000 or $2,800,000 last year. And a large part of this financial and human wastage, he asserted, can be prevented.

Safety Must Start at Top

Like Mr. Zeilinger, it was Mr. Forbes' opinion that accident-prevention work must start at the top. If the key man becomes interested and convinced that much of the accident-budget waste can be eliminated, the subordinate officials, too, will become more interested "and perhaps more observant." Violations of safety rules and practices no longer will be condoned. Correlation of "the three factors" which promote safety will be effected and an attack made upon the 80 per cent of preventable accidents chargeable to man failure as well as the 20 per cent resulting from unguarded machinery or other physical or mechanical hazards.

These three factors, said Mr. Forbes, are: (1) the executive, (2) the supervisors and (3) the men. Management's responsibility includes the selection of proper mining methods; use of safe equipment, proper tools and supplies and adequate ventilation; selection of competent supervisors and maintenance of close contact with their activities. Upon supervisors rests the responsibility for proper maintenance of mechanical and physical conditions, instruction of all employees in the duties they are to perform, enforcement of instructions and appropriate discipline. Supervisors also must assume responsibility for accidents that occur under their supervision, investigate even the most trivial, and attempt to prevent their repetition.

When these things are done, the third factor—the employee—"is morally obligated to cooperate fully in matters pertaining to safety." Management nevertheless, maintained Mr. Forbes, must assume the lion's share of educating the men to acceptance of their obligation, since it is management which creates the working conditions, selects and assigns employees. Moreover, it is management which must bear the burden of accident costs assessed against it by law. So any disclaimer of responsibility "only leaves an unnecessary expense problem unsolved.

"Safety, like quality or quantity of the product," said Mr. Forbes, is a part of regular production methods and as such should be handled by foremen as all other problems pertaining to production are handled. If the quality or quantity of coal produced falls below a certain level, there are certain corrective methods that have proved so satisfactory in the past that the average mine now maintains a good average tonnage per man-day the year round. If safety is ranked with quality and quantity of product, essentially the same methods will enable any mine to operate with a minimum number of injuries."

With the introduction of mechanical loading, explained Manuel J. Grillos, ventilation engineer, Union Pacific Coal Co., ventilation methods have undergone a decided change. In opening a mine, it is now customary to drive the slope and manway along the pitch, with entries on either side at approximately right angles to the slope. Entries are driven in pairs and are separated by a 40- to 50-ft. chain pillar. The lower entry serves as intake as well as for haulage; the top, or breaking, entry is used for the return.

An airshaft is sunk or driven up on the raise from a drift driven off the manway or slope to connect with the main aircourse from the point where the first pair of entries is to be started. After these connections have been made, an exhaust fan is installed on the surface. If development plans call for an overcast, it is put up as soon as the breaking and haulage entries are driven far enough off the slope to make the necessary manway and aircourse connections.

The overcast, continued Mr. Grillos, is built across the haulage entry, giving it a positive air split of its own, so that full development of the entry can be started. Overcasts usually are made of 8-in. concrete slabs reinforced by mine rails set across the entry. Recently, however, worn-out conveyor pans have been lapped over along their edges, laid lengthwise across the entry and concrete poured along these lapped edges; "the result is a very good" fireproof and leakproof overcast.

Crosscuts between breaking and haulage entries usually are spaced 240 to 300 ft. apart. Small blower fans with flexible tubing ventilate advance headings beyond the last open crosscut. Two fans—one for each entry—are set close together at least 25 ft. behind the last open crosscut in the main intake entry. Tubing from each fan is carried to within 40 ft. or closer of each working face. Line brattices as well as blowers are used in gassy mines.

All crosscuts behind conveyors are sealed and made leakproof. Where cover is light and there is no heaving, temporary metal-lath screen stoppings nailed to props set in the crosscut and covered with a thin coat of plaster are used. Where roof pressure is heavy, wooden-block stoppings plastered on one side or props wedged above and below with cap pieces, set skin to skin and plaster-coated, are used. Permanent stoppings usually are built of wooden blocks regardless of cover.

Rooms in Union Pacific mines, said Mr. Grillos, are driven up the pitch with conveyors and entries are worked on the retreat. Air is circulated at the working face in the rooms by the blowers and tubing previously used to ventilate the advancing entry headings. Normal velocity must be maintained on each split as new entries are developed to diffuse and remove blackdamp from the dead ends in the haulage entries. Dependent upon the job to be done, main mine fans at Union Pacific operations vary from one exhausting 45,000 cu.ft. of air to 220,000 cu.ft.; water-gage readings vary from 0.2 to 2.6 in.

Must Check Air Often

Frequent checking of air is a duty of the mine foreman, who takes readings in the main intakes, main returns, at each split and near the face of the entries. A copy of these readings is sent weekly—sometimes more frequently—to the supervisor of ventilation. He in turn checks the foreman's readings at least once a month. The supervisor of ventilation also inspects all main aircourses and notifies the foreman if any caves, leaks or other obstructions to the normal course of the air current are found.

Motion pictures were used for five presentations at the meeting. The story of Utah King coal was offered in a talkie by Paul Shields, assistant general manager, U. S. Fuel Co. This method had been adopted, he said, because after the new Hiawatha cleaning plant (*Coal Age*, June, 1939, p. 39) had been built it was discovered that salesmen were spending too much time explaining the process of cleaning instead of the benefits.

Claude P. Heiner, assistant to the president, Utah Fuel Co., illustrated his talk on the new Castle Gate preparation plant (*Coal Age*, June, 1940, p. 41; July, 1940, p. 36) with a motion picture. Increasing demand for minus 1¼-in. coal and the desire to ship a more consistently uniform product, he explained, had been influential in the decision to build the Castle Gate plant. Since 1929, the percentage of minus 1¼-in. coal had risen from 45 to 72 per cent and some mines are now crushing over 50 per cent of their output to take care of the demand for smaller sizes.

Operation of Joy loading machines, conveyors and shuttle cars in Appalachian area mines was shown in a picture presented by Alex Grant, vice-president and general man-

Operators Pledge Support of Defense Needs

Pledges on behalf of bituminous coal producers of whole-hearted cooperation to meet the needs of national defense with respect to fuel supply, and assurances that there need be no apprehension as to any coal shortage were contained in a telegram to President Roosevelt from the National Coal Association sent on June 14. The message was dispatched following consideration of the industry's situation at a special meeting of the board of directors at White Sulphur Springs, W. Va.

The text of the telegram follows:

"By unanimous direction of our board of directors, in session here today, and speaking for the producers of bituminous coal from coast to coast, we pledge their every effort and whole-hearted cooperation in all matters pertaining to the nation's fuel supply in any emergency. The existing facilities of our industry—mines, machines and men—are sufficient to step up the production of bituminous coal to whatever extent may become necessary to meet the needs of national defense. Producers of bituminous coal are confident of their ability to supply the fuel demands of industry, public utilities, the railroads and the general public under all circumstances, and, assuming the full cooperation of the mine workers and the adequacy of transport, we foresee no basis for apprehending any coal shortage."

The Ghost of the Old Gray Mule

A typical example of Goodrich improvement in rubber

HUNDREDS of feet below the earth's surface mechanical cutting machines slice coal from a rich vein in a newly-mechanized mine. Then it's loaded into five-ton cars. But there's no mule or mine locomotive to haul the cars away. No, sir! Rubber-tired electric trucks are on the job with all the speed and economy of hauling over the highway.

It's a new job for tires. And a tough one. Rubber rides over sharp, jagged edges of coal, never touches a pavement. Starts and stops are frequent. Loads are heavy. But the special Silvertown Tires recommended by Goodrich engineers solved every problem. Now more and more mines are using this new money-saving hauling method.

Maybe you have a truck tire problem. Premature failures, perhaps. Rapid tread wear. Punctures. No matter what it is, we believe our engineers can cut your costs, improve your service.

The new Goodrich Triple Protected Silvertown is now built in types and sizes to fit dozens of special hauling jobs. There's the Heavy Duty type for general trucking; a special trailer tire for free-rolling wheels; the new Store-Door for delivery trucks (a tire which often increases mileage 50%); several types of Super-Tractions for off-the-highway service; and many others.

Goodrich is constantly bringing out new truck tires; recently announced the Heavy Duty Commercial Cavalier for light trucks, a full-size truck tire at less than passenger car tire prices!

Only when you have tires *correctly tailored to your needs* can you get the service you want and lowest cost. If you are not getting that service, call the Goodrich man. Remember which, the name's Good*rich*. The B. F. Goodrich Company, Akron, Ohio; Los Angeles, Calif.; Kitchener, Ontario.

Goodrich Silvertowns
FOR TRUCKS AND BUSES

(Another story of Goodrich development appears on page 1)

ager, Coal Mine Management, Inc. A fourth movie, featuring duckbill shaker conveyor operation with a three-man crew in Kentucky, was offered by C. E. McWhorter, Denver district manager, Goodman Manufacturing Co. Mining, preparation and refining at the potash mine, Potash Co. of America, Carlstad, N. M., were covered in another film; scraper loading is used underground.

Coal, in common with all industry, declared Burt B. Brewster, editor and publisher, *Mining and Contracting Review*, has suffered from the effects of the administration of the Wagner Act by the National Labor Relations Board. Now, as a result of the decision in the *Cornucopia Gold Mines* case, coal mining is directly menaced. Administration of the act by the present board, as disclosed in the recent House committee investigation, has prevented some industries from securing government contracts and blacklisted others with the RFC. These and other "improper acts and policies" have greatly diminished the purchasing power of the industry and its workers. Many of the employers and employees so affected, he added, are consumers of bituminous coal.

In the Cornucopia case, the board abrogated an agreement which provided that the men should work six hours daily at the face. The board's decision, upheld by one of the lower courts, adjudged the employer liable for two hours' overtime for each day the men went to and from the face on their own time. "What," asked Mr. Brewster, "is there to prevent the board from attempting to force the bituminous industry to pay overtime for going to and from the face under the contract with the United Mine Workers? If one agreement which did not violate the hours-of-labor provisions may be broken, why not any contract?"

More Coal Man's Burdens

"New Deal" legislation, declared Floyd R. Pool, vice-president, McNeil Coal Co., has placed new burdens on mine management. How, he asked, is management meeting those burdens? How are the top executives meeting their responsibility for explaining the effects of this legislation on costs to their subordinate supervisory officials, including face bosses? The Guffey-Vinson act, for example, not only imposes a tax but sets up some specifications and size standards as they relate to prices. Have the men at the mines been told?

Social security legislation, continued Mr. Pool, also adds to the tax burdens. The 1 per cent charge for old-age benefits is the equivalent of the wages of 1⅔ shifts; when it rises to 3 per cent, it will equal the cost of five shifts. Have these taxes been loaded onto production costs or absorbed? How dismissal notices read also may affect the tax bill and production costs. Because union wage rates are higher and hours shorter than those specified in the Hours-and-Wages Act, is it safe to assume that law does not apply to mine employees not covered by union contract?

Since the industry must pay a 2 per cent tax on all supplies to support old-age pensions, more attention should be paid to the scrap pile. A good mine mechanic can save the company a lot of money salvaging material from the scrap pile—and the tax already has been paid on such salvage. Even the lowly shovel should not be beneath managerial scrutiny. How many tons are handled before a particular shovel is worn out? Compensation laws are not of New Deal origin but New Deal influence is liberalizing their terms. Accident-prevention work, which must start at the top, asserted Mr. Pool, is the only way to save compensation costs.

A continued fight on the Neely-Keller Federal mine-inspection bill was urged by Sharp Hanson, retiring president, in opening the meeting. He also protested the dismissal of Dr. John W. Finch as director of the U. S. Bureau of Mines and thought that the institute should voice its disapproval. Although the bituminous industry is at a low ebb, he concluded, it is subjected to detailed regulation and onerous taxation while competitive fuels are permitted to run riot.

The report of the resolutions committee, which was confined to departed members and praise for the manner in which the convention had been conducted, was accepted but criticized for its failure to express any opinion on important legislation and other questions. Burt B. Brewster and D. H. Pape led in the attack. A motion by Mr. Pape for the appointment of a new committee with power to act on behalf of the institute in formulation and circulation of resolutions on these questions was adopted. Messrs. Brewster, Pape and H. C. Marchant were named as members of the new committee.

Fleissner Process May Help

Improvement of high-moisture, low-rank coals by the Fleissner process was suggested as a means of widening the markets for Western sub-bituminous and lignite coals in a paper by V. F. Parry, senior fuel technologist, U. S. Bureau of Mines, Golden, Colo. This process, first developed in Austria, lowers the moisture content by subjecting such coals to saturated steam at high pressures. Pilot-plant experiments in this country have demonstrated that the Fleissner process is adaptable to American coals.

Moisture content of some coals tested had been reduced as much as 50 per cent, with an increase of approximately 30 per cent in B.t.u. value. Capital investment for a plant handling 400 tons of raw coal in 24 hours and cost of treatment were estimated by Mr. Parry at 52c. per ton if the plant operated 300 days per year and at 65c on a 200-day basis. These figures were based on a treatment cycle of 100 minutes. Mr. Parry and his associates hope to reduce this cycle to 60 minutes, with a resultant substantial saving in costs.

Because, apparently, the Fleissner process shrinks, if it does not destroy, the cellular structure, stated Mr. Parry, the treated coal does not reabsorb moisture on subsequent exposure to the air. Slacking properties, therefore, are greatly reduced. Friability, however, shows a sharp increase after treatment. This, it was pointed out in comments from the floor, would be a serious handicap in selling the treated coal to retail dealers who naturally wanted to avoid degradation in handling. The answer to this objection, suggested Mr. Pape, might be in drying by the Fleissner process and then briquetting the dried product.

Coming Meetings

- Southern Wyoming Coal Operators' Association: annual meeting, July 9, Cheyenne, Wyo.

- Sixth Annual Southern Appalachian Industrial Exhibit: Aug. 22-24, Norfolk & Western Freight Terminal, Bluefield, W. Va.

Personal Notes

IRA CLEMENS, president, Commercial Fuel Co., Pittsburg, Kan., received an honorary degree of Doctor of Laws at the commencement exercises on May 30 of Creighton University, Omaha, Neb. This honor was bestowed upon Mr. Clemens for his aid in sending many boys through school in the last fifteen or more years. He was fuel administrator for the Midwestern States during the World War, and an original director of the National Coal Association, serving continuously since its founding.

DR. ARNO C. FIELDNER, chief, Technologic Branch, U. S. Bureau of Mines, has been awarded the Joseph Sullivant medal for 1940 by Ohio State University. The medal is bestowed every five years to an alumnus credited with "an admittedly notable achievement."

WILLIAM FINDLAY, JR., general superintendent, Simpson Creek Collieries Co., has been reelected president of the Northern West Virginia Coal Association. Other officers, also renamed, are: vice-president, SAMUEL PURSGLOVE, SR., vice-president in charge of operations, Pursglove Coal Mining Co., and secretary-treasurer, T. E. JOHNSON, vice-president in charge of operations and sales, Hutchinson Coal Co.

O. M. GORDON, vice-president and treasurer of the Bell & Zoller Coal & Mining Co., Zeigler, Ill., retired from active business as of June 15. He joined the company in 1918 as auditor, becoming secretary a year later. He was advanced to treasurer in 1927, upon the retirement of W. G. Zoller.

HARRY LAVIERS, vice-president and general manager, South-East Coal Co., was reelected president of the Big Sandy-Elkhorn Coal Operators' Association at its annual meeting, June 7. Other officers renamed were: vice-president, L. C. CAMPBELL, assistant to the vice-president, Koppers Coal Co.; treasurer, H. H. KUHLING, Elkhorn Collieries Corporation; secretary, H. S. HOMAN.

C. C. MOORE has been made superintendent at the Blocton mine of the Black Diamond Coal Co., West Blocton, Ala., vice J. P. Upchurch, transferred.

RALPH RICHART, electrical engineer for the Union Colliery Co., Dowell, Ill., has resigned that position to accept a post as technician in connection with the development of a process for briquetting Illinois coal. This work will be carried on by the State Geological Survey, under direction of Dr. M. M. Leighton, at the University of Illinois, Urbana.

DR. ROYD R. SAYERS has been confirmed by the U. S. Senate as director of the U. S.

SUPER LUMPS *Hold No Terrors* FOR U.S. RUBBER BELTS

Here, in one of the largest mines in the country, a 30-inch U. S. MATCHLESS Mother Belt is being ruthlessly bombarded by two 18-inch U. S. MATCHLESS anti-drag room belts. Then, under low ceilings, over uneven floors, the coal moves steadily, speedily and efficiently on its 2000-foot trek to the cars.

And it's because U. S. Conveyor Belts are able to take such thorough-going beatings... because, day after day, they absorb this terrific kind of punishment and return doggedly for more... *because they are so constructed that they cannot be affected by mildew* — that more and more U. S. Conveyor Belts are being specified by mine operators and builders of belt conveyor systems.

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Bureau of Mines. His nomination was sent to the upper house by President Roosevelt on May 13. The House agreed to a Senate amendment in the Interior appropriation bill to permit Dr. Sayers to retain his status in the Public Health Service while holding the office of director of the Bureau of Mines.

SCOTT TURNER, former director of the U. S. Bureau of Mines, now vice-president and director of the International Mining Co., New York, received the honorary degree of Doctor of Science from Kenyon College, Gambier, Ohio, at its 112th commencement, June 10.

J. P. UPCHURCH, heretofore superintendent at the Blocton mine of the Black Diamond Coal Mining Co., West Blocton, Ala., has been appointed superintendent at the Capito mine of the Atlas Coal Co., Capito, Ky., a subsidiary of the Black Diamond company.

WILLIAM J. WILLIAMS, mine foreman at Loomis colliery of the Glen Alden Coal Co., Nanticoke, Pa., was honored with a testimonial dinner marking the completion of 50 years' service on May 25, when he retired. The celebration took place at the Redington Hotel, Wilkes-Barre, Pa.

HARRY WILLIAMSON, who has had charge of maintenance of production equipment and locomotives for the Union Colliery Co., Dowell, Ill., has been promoted to the position of electrical engineer, effective June 1.

Appointments to the Illinois State Mining Investigation Commission, announced June 1 by Governor Horner, include: D. D. WILCOX, SAM CAPE and JOHN E. JONES, representing the operators; HERMAN LISSE, BRICE HOLLAND and HENRY VAUGHN, representing the miners; F. W. HECKENCAMP and E. A. POWERS, representing the public. The commission was authorized by the 1939 Legislature to make a broad study of the industry with "special reference to the safety of human life and property and the conservation of coal deposits." It was voted a $10,000 appropriation and instructed to make a report to the 1941 Legislature.

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New Koppers Philadelphia Office

Philadelphia district offices of the Koppers Coal Co. were moved early in June from the Packard Building to the Broad Street Station Building. Warren M. Wells remains as district manager in charge. The Wood Preserving Corporation, a subsidiary of the Koppers Co., has moved its Philadelphia office to the same suite.

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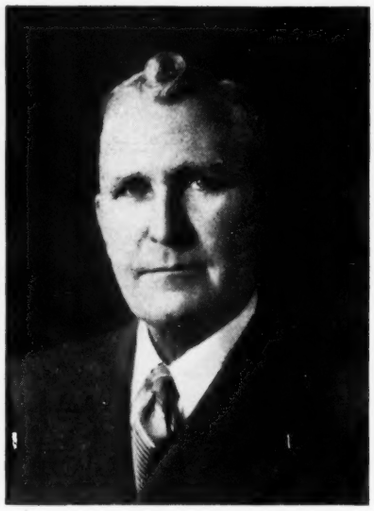
N.C.A. Retains Ad Counsel

The National Coal Association has engaged Arthur Kudner, Inc., New York City, as advertising counsel, according to an announcement on June 17 by John D. Battle, executive secretary of the association. The agency has been instructed to prepare a detailed and comprehensive plan of cooperative industry promotion and advertising for presentation in the early autumn.

How to Maintain Mine Air in Safe Condition, Main Interest at Inspectors' Institute

AIR HAZARDS dominated the program of the 31st annual convention of the Mine Inspectors' Institute of America, May 27-29, Indianapolis, Ind. Gas from oil wells form a new menace to the air of Illinois mines, declared Benn Pitts, State mine inspector, Odin, Ill. All the early oil fields were small and developed in the eastern part of the State, where there were no coal-producing areas. But the southern field, started two years ago, now has 700 producing wells in an area four miles long and two miles wide. The wells are under enormous pressure. Should they leak, gas and oil would seep into the mine.



James McSherry takes the reins

Subsidences, squeezes and creeps, heavy falls of roof or even crooked holes may place enough strain on the casing to break or twist it in two, thus freeing it from the cement. Acid mine water cuts through the pipe in a short time. Thus openings are formed in which gas and oil may travel into the workings. Many holes, though properly surveyed, may be 10 or 15 ft. out of line before they reach the coal seam and, if so, the protection afforded by the pillar will be decreased.

Rules, later made mandatory by statute, provided that when a drillhole penetrated an opening in the mine, drilling was to continue for about 75 to 100 ft. below the mine floor until a solid formation was found on which to set the mine string of casing; this was to be surrounded with cement under pressure, from the bottom of the hole to the mine floor. A cave catcher was to be set on the casing above the mine and cemented from that point to the surface to prevent water from entering the mine workings.

Drilling then continued with a reduced hole until the well was completed, then a second string of casing was set through the first to the bottom of the hole and cemented. Cement was placed between the two casings through the mine to assure protection against leaks. When wells that proved "dry" or ceased to produce were abandoned, a casing was left where they passed through the mine opening; the bottom of the hole was cemented; cementing restarting 50 ft. under mine floor and continuing through mine and 50 ft. over it. The rest of the hole was then filled with drilling mud.

Five points, declared F. W. Howarth, district inspector of Pennsylvania, should be covered by legislation: (1) Complete legal and financial responsibility of the well operator from the time he begins to drill to final abandonment and plugging; (2) location of well should be subject to agreement between well operator, coal owner and law-enforcement agency with complete and permanent record of location; (3) proper casing methods, means of well protection during drilling and life of well, including protection by proper casing through, and sealing below, coal seam should be established; (4) care should be exercised in drilling through active mine workings, in providing adequate protective pillars and for the inspection of casings by legal authorities at time of installation; (5) definite responsibility for law enforcement and establishment of penalties in case of non-compliance.

Pennsylvania Statute Defective

Pennsylvania law unfortunately lacks a provision for preliminary agreement on well location or for insuring responsibility of well operator. Neither is a proper seal or casing at the time of drilling required. Plugging of dry holes or on abandonment of wells was specified in a Pennsylvania act of 1921, but no provision is made for enforcement of the act other than by court action by interested parties. The plugging provisions Mr. Howarth regarded as inadequate. If manner of sealing makes a bleeder pipe necessary, then the bleeder should go to the surface and, though it should be surrounded with cement just below the coal, through the coal and a short way above it, it probably would be better to fill the space with clay to the surface because that would allow some slippage without rupture of casings should the overlying strata move.

Uncharted and inaccurately located gas and oil wells are found in 38 counties of West Virginia, 27 of which also produce coal, declared D. G. Courtney, oil-and-gas inspector, Department of Mines. Many have been encountered in mining, but with no serious damage since 1929. Under the law, wells penetrating coal seams must be located on the mine map by every coal operator. Before mine workings approach the well nearer than 500 ft., the Department of Mines must be notified. Again, before approaching nearer than 200 ft., notice must again be submitted, outlining proposed workings and plan of pillar to protect the mine against the well.

If 200 ft. or more cover is present, a pillar 200 ft. square is required. With a cover under 200 ft. and more than 100 ft., width of the block must equal the cover. For cover less than 100 ft., a pillar must be left equivalent to a square block with dimensions equal to 100 ft. less half the

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difference between 100 ft. and the depth of the cover. Nowhere, however, shall a pillar less than 60 ft. be left.

After a proper pillar plan is proposed, continued Mr. Courtney, the department notifies the well operator and, if no objections are made, a permit is issued. Every six months the coal operator must submit a new map showing the progress of mining in the vicinity of the well. Before any well operator may drill on a tract known to be underlaid by coal, he must have an engineer prepare a plat showing district, county, tract name and acreage with names of adjacent tract owners and notify the department and every operator of the tract to be drilled. Locations must be so made that a pillar of coal can be provided for protection against the well.

How Casing Is Set

Holes, added Mr. Courtney, usually have a diameter of 16 in. and the largest string of casing is set at least 30 ft. below the lowest coal bed and cemented behind the casing through the coal seams, so that the casing will not be dislodged under high gas pressure, nor will oil or gas force its way into the coal. In coal territory not being operated, the coal-protecting string of casing may be uncemented, but must be seated at least 30 ft. below the lowest coal seam and provided with a steel shoe on the bottom of the casing in 20 ft. of cement or other non-porous material.

Mined-out areas may not be drilled unless sufficient time has elapsed for proper subsidence, and the well must be located at least 200 ft. from solid coal. The liner must extend at least 20 ft. above the coal —usually to the surface. Within the liner must be placed the largest size of casing to be used in the well, with space between the two filled with concrete as they are lowered into the hole. When the well is exhausted, its owner must notify all interested parties and get a permit to plug it in the manner prescribed by the Department of Mines.

A hole drilled alongside the well, or just outside the mine pillar, from the surface would vent any gas that might escape from the casing, asserted R. D. Hall, engineering editor, *Coal Age*. Any vent pipe solidly concreted in the well might be sheared by movement of the measures over the mined coal. Around a pillar in the goaf is usually an open space, and all the gas escaping into it would have access to the borehole. Richard Maize, Pennsylvania district mine inspector, urged that bleeder pipes be not cemented but surrounded by a material that would yield to a movement of the pipe relative to the hole, otherwise the pipe might shear.

At the Bracewell mine, Swastika, N. M., where a dike in the intake persistently leaked large volumes of methane, commented Thomas Allen, chief inspector of coal mines, Colorado, a big funnel was built over it with a pipe leading to the return airway. In a place leading to an abandoned panel working, a concrete stopping was erected with pipe and valves so that the condition of the atmosphere behind the stopping could be observed.

A disposition to believe in magic and to regard American medicine as helpless where injuries needed healing made the introduction of first aid appear hopeless in the Philippine mines, but, said, A. J. Toering, export department, Mine Safety Appliances Co., in a screen lecture, it was taught as a game. Soon the men became expert, and captains sought other men from outside the mines as fellow crewsmen. The result was successful training, most helpful first aid, a phenomenal lowering of lost-time accidents, and a disposition to accept the services of American doctors.

In the year ended March 31, 1940, said J. E. Tiffany, explosives testing engineer, U. S. Bureau of Mines, about 30,000,000 tons of coal was brought down by 4,000,000 charges of Cardox, consuming 10,000 tons of carbon dioxide. The worst single hazard of Cardox is the liability of the shell to fly out of the hole when fired, which usually occurs as the result of shooting the hole on the solid. Faulty assembly of shell may cause a misfire which misassembly the galvanometer may not reveal. Premature explosions are commonly due to lack of reasonable precautions in transportation. Haulage in insulated cars would reduce this hazard materially. Terminal plugs should not be inserted in the shell until it has been placed in the hole and then only when ready for the connection of lead wires. Using a nail in place of the plug has caused several explosions.

Cardox emits mostly carbon dioxide. Four Cardox shells of a large model would develop about 1.8 cu.ft. of carbon monoxide. Nine shells, said E. Gertz, would liberate only that quantity of the gas. A sample taken by someone as soon as he could get back to take it showed only 0.01 per cent of carbon monoxide in the air after firing five Cardox shells in the room neck of a heading. Quantities of carbon monoxide, declared Mr. Tiffany, depend on variable circumstances but partly on the size of the shell.

Pellet powder, remarked Fred Ferguson, director, Indiana Bureau of Mines and Mining, is somewhat safer than ordinary black blasting powder because of the greater safety of the containers in which it is delivered; the wrapper is a further protection. Shooting too large a charge with Cardox often causes flying shells. Hazards in transportation practically could be eliminated if a non-conducting cap were placed over the end of the shell where the wires are to be connected. Such a rubber cup as sometimes is used with a wooden plug for tamping shots would serve this purpose.

When using Airdox, dust should be eliminated by scraping or by washing out the drillhole with water. Holes should not be drilled on the solid or into the roof. The shell must be pushed to the end of the hole and then withdrawn far enough to provide an air cushion. Shells must be disconnected from tubing when not in use, and air-release valves always kept open. Line valves must be closed, and all pressure shut off from the air tubing when not in active use. Where this line crosses under or over a trolley wire or other electrical conductor, it must be insulated with rubber hose or wood.

Most of the permissible explosives, declared Mr. Gertz, when fired directly into an explosive mixture of gas will fire the mixture, but Cardox tests in the same mixture will not do so. Cardox makes moisture because, by expansion, it cools the air, which then deposits the water which it can no longer carry at the lower temperature.

Some Indiana companies do not seal the last room panel as soon as it has been worked out, and meantime this panel is inspected daily, said John Ogilvie, safety engineer, Lynch Coal Operators' Reciprocal Association. The section is kept open until the rooms in the adjacent panel are completed. This is done, lest by mistake a working place be holed into it, releasing gas that, because of sealing, would have accumulated in it. However, Mr. Ogilvie favored a different policy—the immediate erection of seals as soon as a room panel has been completed.

Must Be Concrete or Brick

According to Indiana law, such seals must be concrete or masonry. The floor is cut down to solid rock (about 3 ft.). Ribs are recessed for a width of 3 ft., the thickness of the seal when erected. Only loose roof should be taken down. With brick seals, a slush mixture of reinforced concrete should be run into the floor cut until it is filled to the level of the bottom of the coal. Seals should be built outward from the hitchings in the rib toward the center, leaving an open space in the center of the seal about 4 ft. square. The stopping is then completed two-brick thick to the roof.

If seals are to shut off old workings, both intake and return seals should be completed in this manner at the same time, in Mr. Ogilvie's opinion. After seals are built to the full width of 3 ft., they should be coated with plaster, when the seals are inhaling air; if put on when exhaling, small bubbles will be created that later will be leaks. Concrete stoppings may be reinforced and should be built to within 2 ft. of the roof and finished with brick, as it is difficult to build up concrete tightly to the mine top without having leaks. For taking samples a locked valve, not a plug, should

Lead Mine Inspectors' Institute 1940-1941

James McSherry, director, Department of Mines and Minerals of Illinois, Springfield, Ill., president; Thomas Moses, president, U. S. Steel Corporation of Delaware, Pittsburgh, Pa., first vice-president; N. P. Rhinehart, chief, Department of Mines of West Virginia, second vice-president; Fred Ferguson, director, Bureau of Mines and Mining of Indiana, Indianapolis, third vice-president; C. A. McDowell, Pittsburgh, Pa., secretary; J. J. Forbes, supervising engineer, U. S. Bureau of Mines, Pittsburgh, Pa., assistant secretary; J. J. Rutledge, chief mining engineer of Maryland, Annapolis, Md., treasurer; J. W. Paul, consulting engineer, Pittsburgh, Pa., editor-in-chief; Richard Maize, State mine inspector, Uniontown, Pa., assistant editor-in-chief; J. T. Beard, Danbury, Conn., emeritus editor-in-chief; R. D. Hall, engineering editor, *Coal Age*, New York, N. Y., publicity editor; J. T. Ryan, general manager, Mine Safety Appliances Co., Pittsburgh, Pa., chairman, program committee.

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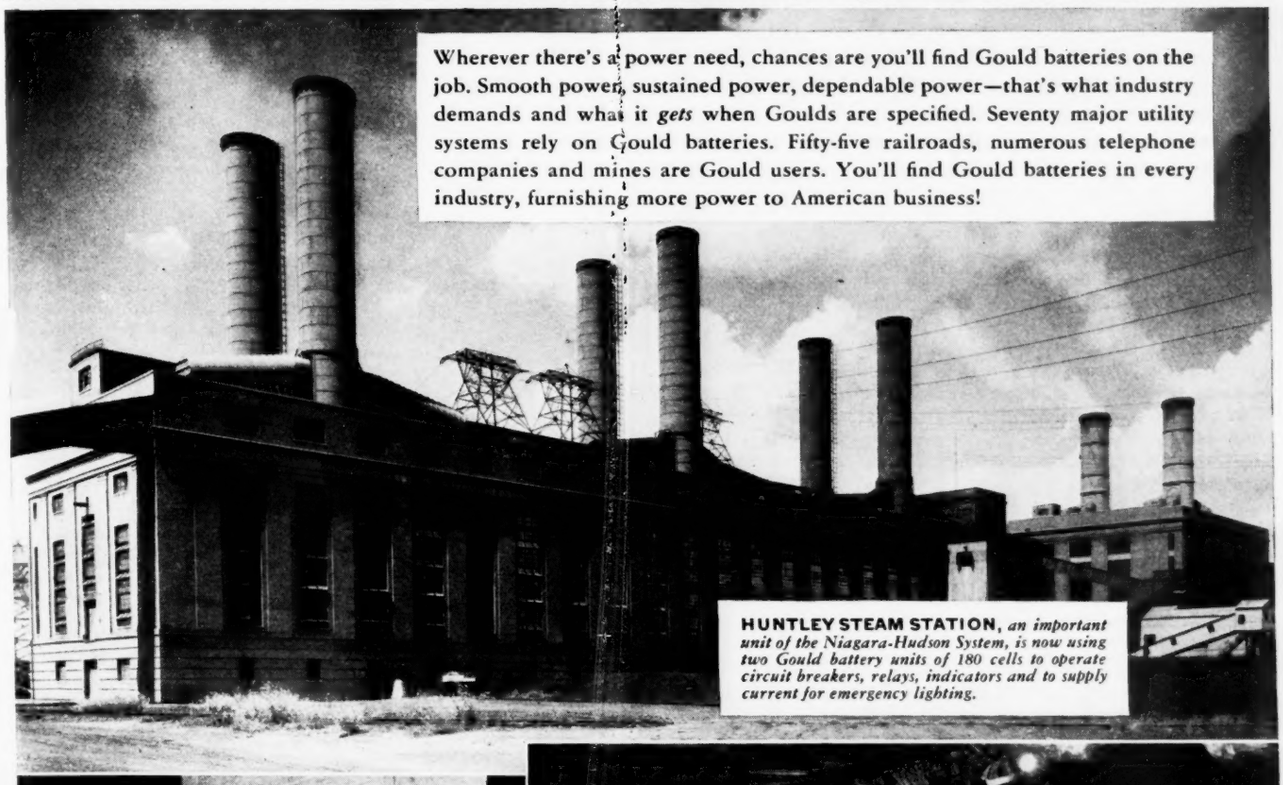

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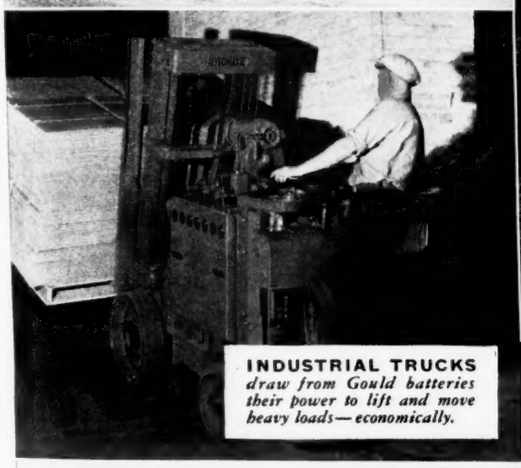

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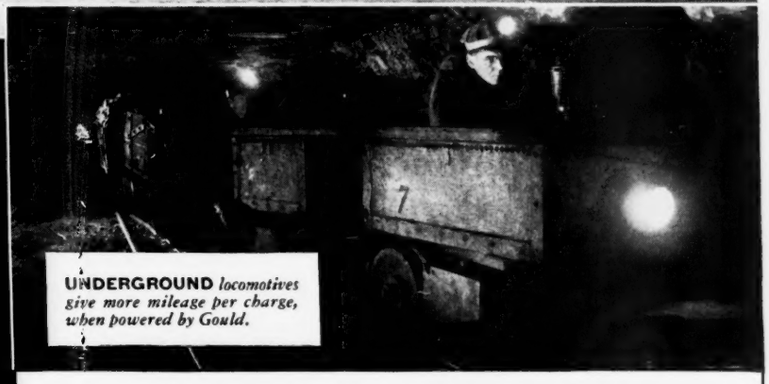

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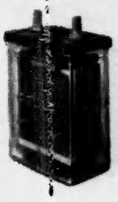

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be put in one of the seals, not less than 2 ft. from the roof. A 4-in. locked valve should be placed near the bottom of the seal to allow any water behind it to be drained.

Seals should be protected by timbering both inby and outby. Recently, it has been the practice to erect concrete walls along each rib for 6 ft. inby and outby, and on these walls steel crossbars have been placed. Seals should be built between the first crosscut and the heading. Despite the law, Mr. Ogilvie thought, the first crosscut should be 75 ft. from the entry, for, if the fan should stop and barometric pressure should be low, there would be some leakage which would be a longer time reaching the entry if the distance were greater.

Ventilation should be led into the seals by nailing galvanized-iron sheets to a line of posts extending to the seal from a point 3 ft. out on the crossheading. Only after three months will the oxygen in a sealed area drop below 1 per cent. When oxygen increases to above 1 per cent, the seals must be examined, or spontaneous combustion may result. Air behind seals never should be released. One must beware of pumping water from behind seals, for, if pumped too low, the pump may draw gas instead of water which may be ignited by the pumper. One man was thus killed. All valves should show the depth of water, if the water is to be pumped.

Above No. 5 seam in Knox County, over the first 6-ft. layer, which is of shale, is a "steel band" 18 in. to 3 ft. thick. When it breaks, gas comes in quantity, so that the mines could not be operated without sealing. Because of the seals, the return air has only about 0.2 per cent methane. Sealing reduces resistance to the air current and also the number of firebosses needed to examine the mine. If a heavy fall comes after inspection of an open panel, the gas will be thrown into the airways, but with a sealed panel the gas still remains under control after a fall.

Sealing Practice in Illinois

In most Illinois mines, remarked Leonard Forester, State mine inspector, Percy, Ill., it was almost impossible to keep open a panel of completed rooms while awaiting the extraction of another panel, so sealing has to be done soon after a panel is finished. Moreover, with lax supervision, the rooms often travel into the 50-ft. pillar supposed to be left as a barrier between panels. Advantages of sealing are air conservation, elimination of hazard involved in keeping mined areas open, prevention of coal or gob fires and protection against gas and oil from wells. Mr. Forester said that, with a tight seal, pressure was reasonably sure ultimately to decrease behind seals.

Most mining men from Indiana, Illinois and Colorado believe, said Mr. Maize, that a mine cannot be operated safely unless abandoned workings are sealed; Pennsylvania, West Virginia and Kentucky operators are just as sure that sealing should not be permitted. Within reasonable limits, both schools of thought are right, because those who favor seals have coal that fires easily from spontaneous combustion and have coal that is not as valuable as that, at least, in the Pittsburgh-bed district.

Sealing is not forbidden by Pennsylvania statute, explained Mr. Maize. An accumulation of explosive or noxious gas must be removed in the worked-out or abandoned portions of any mine as soon as possible after discovery, if it is practicable to remove it. If a way to remove explosive gas from the inaccessible top of a fall cannot be found, the inspector shall direct that a borehole or boreholes not less than 6 in. in diameter be drilled from the surface to the high point on such fall. Sealing in some instances, however, may be necessary. Fatalities have resulted from leaking stoppings in Illinois and Pennsylvania. When mines are operated on the full retreat system, added Mr. Maize, there are no worked-out and abandoned workings for the intake air to pass before reaching working places.

Losses Exaggerated

No place should be sealed if there is risk of a squeeze, declared H. G. Houtz, mining engineer, West Virginia Department of Mines. Too much has been said about the loss of coal where mine sections are sealed, said James Hyslop, general manager, Snow Hill Coal Corporation. It is possible to seal and get 90 per cent of the coal. There is no risk that properly built seals will be blown out. With proper methods, none of the accidents from sealing would have occurred.

So much coal is broken per day and so much new face emitting methane is opened in a mechanized mine that laws framed for hand-loading mines are inadequate both as to cubic feet of air per individual or per split, asserted Stephen Krickovic, inspector, Koppers Coal Co. In some cases, methane generation near the start of the split may climb up unexpectedly and may reach 1 per cent where 0.5 per cent is the desired value. When a split returns by two channels, one should not assume that both have the same methane concentration but sample both.

Don't provide six airways and forget about them, continued Mr. Krickovic; better three airways well kept. Let them be so connected as to equalize the volumes carried. Headings should not be driven too wide: car width, plus legal clearance, plus space for timber is preferable, for then roof falls will be less frequent. Intakes and returns always should be in duplicate, for a high fall in one of them that will shut off the air may not be detected in time. Checks may be more desirable than doors in a mechanized mine, especially with shuttle-car operations. Present-day line brattice is too porous. More than 2,000 cu.ft. of air per minute is needed at the face at the head of a line brattice; 5,000 or 6,000 cu.ft. is desirable.

Permissible Plates Issued

Two approvals of permissible equipment were issued by the U. S. Bureau of Mines in May, as follows:

Sullivan Machinery Co.: Type 7-B-1 shortwall mining machine; 50-hp. motor, 250 volts, d.c.; Approval 407; May 4.

Goodman Manufacturing Co. (Mancha Division): duPont hydraulic cartridge pump (caterpillar mounted); three motors, 15, 7½ and 1½ hp.; 250 volts, d.c.; Approval 408; May 15.

Air will lift much fine dust from belt conveyors when the movement of the coal is opposed to the movement of the air, noted G. E. Bayles. This forms heavy accumulations of fine dust at the inby end of the belt gallery. For this reason, air currents were reversed in two conveyor operations, and in a third case, where the air could not be reversed, conveyor transportation was abandoned. Power cables are laid on the bottom, and with much fine coal gathers under and around them. The number of men working in a place is also greater than in hand loading; so a local flash or minor dust ignition might reach disaster proportions. Sharp bits, coarser cutting-chain lacings, and thin-kerf cutter bars should reduce explosive-dust production. Overshooting by use of a high-speed or more violent explosive than necessary will produce excessive dust.

Slate from the Kellioka seam was dumped over an abandoned drift in the Harlan seam and the rock caught fire, said J. F. Bryson, director of safety, Harlan County Coal Operators' Association. One night, the power being off, the fan stopped for 90 minutes and gases from the fire entered the mine. On starting the fan, a small explosion occurred. The mine foreman and motor boss went in later and were brought out dead. Had self-rescuers or gas masks been used, the fatalities would not have occurred. A short circuit in another mine caused a fire which suffocated a fireboss and then another man who went in to warn the workers still underground. Mr. Bryson instanced also a gas ignition in a crosscut in which two men died from afterdamp. He urged the more general use of detective and protective equipment.

Lack of training is the fundamental cause of most accidents, declared C. A. Sine, safety engineer, Stonega Coke & Coal Co. The two-way telephone is a marvelous assistance, said Mr. Maize. A five-man apparatus crew entered a mine, and two men went down from some defect. The telephone enabled communication to be made with the base, and the men were brought out, but artificial respiration had to be given them several times on the way to the surface.

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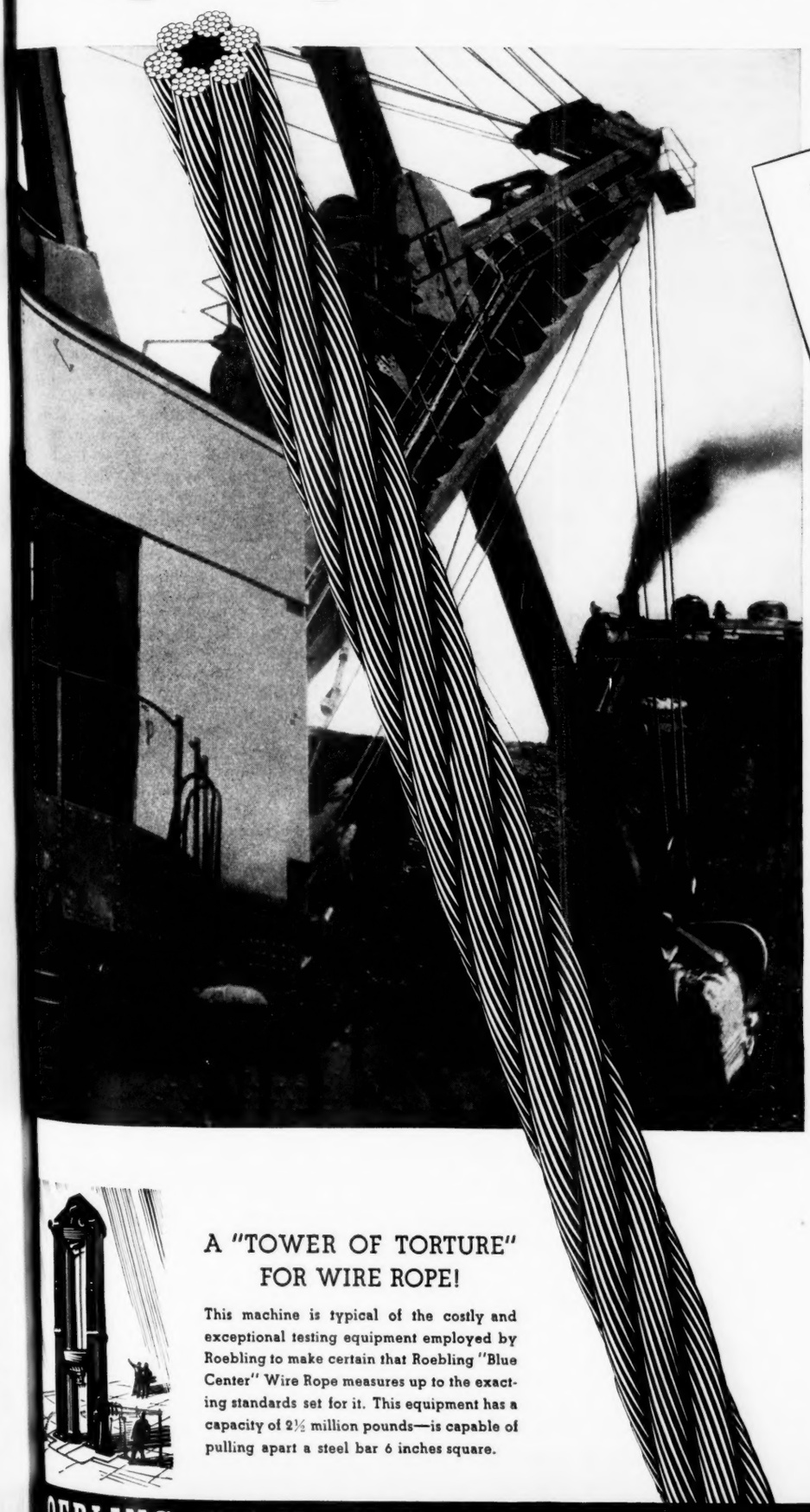
Industrial Notes

Linde Air Products Co., a unit of Union Carbide & Carbon Corporation, New York City, has elected T. D. Cartledge and L. A. Bliss as vice-presidents, and E. J. Hayden as vice-president, Central Division. Mr. Cartledge has been general sales manager; Mr. Bliss, works manager of the company; and Mr. Hayden, manager of the Central Division. E. B. Suydam, formerly assistant general sales manager, has been appointed general sales manager and P. B. Pew, formerly assistant works manager, has been moved up to works manager. C. K. Bryce has been elected vice-president of Oxweld Acetylene Co., another unit of Union Carbide & Carbon. He was formerly manager of factories.

Air Reduction Sales Co. has appointed E. H. Anchors as manager of its Oklahoma City (Okla.) district. He was formerly branch manager at Atlanta, Ga. R. C. Hale

Strip Rope Costs to the Bone...



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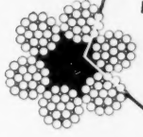

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has been appointed purchasing agent by Air reduction Co., vice H. H. Daggett, retired.

DURALOY CO., Scottdale, Pa., has made Dr. Howard A. Smith its chief metallurgist. Until recently he was research metallurgist with the Rustless Iron & Steel Co., Baltimore, Md., and previously was in charge of stainless-steel development in the laboratories of Republic Steel Co. at Canton, Ohio.

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis., has established a new branch office in the Knight Building, Charleston, W. Va. R. L. Halsted, formerly connected with the company's Cincinnati district office, has been made branch office manager. J. E. Despins, mining division, has been transferred to the El Paso district office as office engineer.

ELASTIC STOP NUT CORPORATION has moved its general offices from Elizabeth, N. J., to its new plant at 2332 Vauxhall Road, Union, N. J., a suburb of Newark. The Houston (Texas) office has been moved to the Merchants and Manufacturers Building.

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Hearing Set on Proposed Order Limiting Age of Mine Labor

A public hearing is to be held June 28 to consider a proposed order declaring work in coal mines to be hazardous for minors between sixteen and eighteen years of age, it was announced on June 11 by Miss Katharine F. Lenroot, chief of the Children's Bureau of the U. S. Department of Labor. The hearing is to be held in the U. S. Department of Labor Building, Washington, D. C. If adopted, the order will establish an eighteen-year minimum age, under the child-labor provisions of the Fair Labor Standards Act, for most employment in and about coal mines. It will apply to all coal mines whose products are shipped in interstate or foreign commerce.

The proposed order declares as hazardous for minors between sixteen and eighteen years of age "all occupations in or about any coal mine, except the occupation of slate or other refuse picking at a picking table in a tipple or breaker, or occupations requiring the performance of duties solely in offices or in repair or maintenance shops located in the surface part of any coal-mining plant." The order is to become effective Sept. 1.

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P. C. Graney With New Company

The Gulf Mining Co., a new organization headed by P. C. Graney, has taken over the operations of Lilly & Hornbrook, Inc., in the Winding Gulf district of West Virginia. Capacity of the Crab Orchard mine, acquired in the deal, is to be doubled by the new owners from 500 to 1,000 tons per day. To make this possible new sidetrack facilities, tipple and other improvements will be installed. Headquarters of the new organization will be in Mount Hope, W. Va. Besides Mr. Graney, formerly general manager of the C.C.B. division of the Koppers Coal Co., officers of the company include P. M. Snyder Jr., vice-president, and DeWitt C. Snyder, secretary-treasurer.

More Markets and Mechanization Canvassed At Charleston as Cure for Coal Slump

MAIN stress in the program of the meeting of the Coal Division, Ohio Valley Section, American Institute of Mining and Metallurgical Engineers, Charleston, W. Va., May 25, was laid on markets—new markets, markets that are dwindling but may be and probably will be revived, the domestic stoker, marketing agencies and New World markets. Mechanical mining was featured in two papers.

Consumption of large quantities of coal in the coke ovens and for combustion at the Belle works of E. I. duPont de Nemours & Co. awakens renewed interest in the possibility of finding new coal markets in the chemical industry. Any chemical derived from coal, however, probably could be obtained from petroleum or natural gas or *vice versa*, said Dr. J. S. Beekley, manager, Process Section, at the morning session, presided over by J. E. Tobey, vice-president, Appalachian Coals, Inc. Transformation, however, could not be effected with equal facility from each of the three sources and hence not at the same cost.

The light oils—benzene, toluene, xylene, etc.—enter the new formulas for paints and lacquers, serve as raw materials for new dyes and furnish the chemicals required in the modern compounding of rubber. Benzene, in large volume, is used to augment the supply of phenol. From phenol are made some of the synthetic resins and this chemical also is used in making Nylon. Hydrogenated phenol, cresol and naphthalene yield powerful solvents. Byproduct sulphur recovered in extremely fine form is useful as an insecticide.

Reaction of coke with lime yields calcium carbide, which in turn yields acetylene. From this comes, among a long list of products, the polyvinyl resins, such as duPont's Butacite, which has made possible super-safety glass, synthetic rubbers such as du Pont's Neoprene and the German Buna and acetic anhydride, but there are more ways than one of getting acetylene from natural gas and oil, and it is obtained from these sources in this country to a fairly large extent.

In the Belle plant, gas generators cause a reaction between the carbon in the coal and the oxygen in steam to form carbon monoxide and to release hydrogen. Nitrogen and hydrogen for upward of 25 years in Germany and for 14 years at the Belle works have been synthesized into ammonia in the presence of a catalyst. At the latter plant, a pressure of 12,000 lb. per square inch is used to assist in the reaction. In an entirely different operation, carbon monoxide and hydrogen, though their proportions in water gas have to be changed, are converted into methanol.

Among the products of coal treatment at Belle works, Dr. Beekley listed urea, extensively used as fertilizer ingredient and in making synthetic resins; acetic and propionic acids, methyl methacrylate (Lucite), esters for solvents, formamide, ethylene glycol and Nylon intermediates. Hydrogen from coal makes coconut oil yield detergents, castor oil develop into a high-melting wax and naphthalene become solvents.

Nylon is the generic term of a family of synthetic linear superpolymers developed, said Dr. Beekley, in research into the building of large molecules from small ones. It is a proteinlike crystalline product (polyamide) which may be formed into fibers, bristles, sheets and other forms which are characterized when drawn by extreme toughness, elasticity and strength. Polyamides may be made in many ways, one of the simplest being by a reaction of a dibasic acid with a diamine. Both are made from phenol, which in turn is made from coal. Asked whether agricultural products might form a rival of coal products in the manufacture of Nylon, Dr. Beekley asserted that one or two types of Nylon have half their origin in vegetal products.

To the mining industry it has appeared always that the only and the desired outcome from the direct hydrogenation of coal and coal tar is a liquid fuel that will compete with gasoline, but many other valued industrial compounds (see Table I) can be made that will not have to compete with liquid fuels, declared Dr. H. H. Storch, supervising physical chemist, U. S. Bureau of Mines. At present prices the production cost of these using today's hydrogenation methods would be about 2c. per pound.

Breaking down complicated and highly polymerized structures such as are found in coal into simple, unpolymerized compounds or even elements and following this by rebuilding, or synthesization, into complicated and highly polymerized structures seems scientifically wrong, urged H. H. Lowry, director, coal research laboratory,

Table I—Products Obtainable From Coal by Hydrogenation

Compounds Derived by Hydrogenation	Percentage Volume of Topped Byproduct Tar to 207 Deg. C. Boiling Range	Gallons per Ton of M. and A. F.* Coal to 207 Deg. C. Boiling Range	Percentage of M. and A. F.* Coal to 235 Deg. C. Boiling Range
Phenol	0.27	....	1.07
Cresol	0.76	....	3.75
Xylol	....	....	4.12
Tar Bases	....	....	1.76
Benzol	1.79	2.17	....
Toluene	5.96	2.06	....
Xylene	6.19	9.08	....
Cyclohexane	2.26 }	8.88	....
Methylcyclohexane	2.69 }		....
Dimethylcyclohexane	1.58	6.52	....
Tetrahydronaphthalene	11.70	20.10	....
High-flash naphtha	69.60	95.20	....

* Moisture and ash-free.

Carnegie Institute of Technology. This indirect method gives only paraffinic oils with an octane value of 40 to 50, whereas the direct method gives octane ratings of 70 to 90. From coke made at 700 deg. C. of Pittsburgh-bed coal, mellitic acid can be separated.

In the open-hearth smelting, melting speed determines tonnage, yield and quality of product, and the characteristics of the fuel determine whether the furnace will melt fast or slow, asserted H. V. Flagg, combustion engineer, American Rolling Mill Co. Table II shows how coal has been displaced in sheet manufacture. However, much of the total production is still finished by hot-reduction methods, but even here improvement in process and substitution of other fuels has reduced fuel consumption. In 1927, the American Rolling Mill Co. consumed 230,000 tons of gas coal to produce and process 365,000 tons of ingots (1,260 lb. per ton of ingots) and in 1939 consumed only 40,000 tons to process 581,000 tons of ingots (137 lb. per ton).

Table II—Fuel to Make a Net Ton of Auto-Body Sheets in 1927 and 1940

Operation in Sheet Mill	Type of Fuel Used in Operation in 1927	Equivalent Pounds of Coal Adjusted for Yield, 1927	Type of Fuel Used in Operation in 1940	Equivalent Pounds of Coal Adjusted for Yield, 1940
Second Annealing	Coal on Stokers	217	Natural Gas	149
Normalizing	Washer Producer Gas	580	Natural Gas / Slab Furnace	150
Sheet Mill	Coal on Stokers	370		
Soaking Pits of Bar Mill	Producer Gas	221	Natural Gas	143
Open Hearth	Producer Gas	1,080	Fuel Oil	413
Blast Furnace	Coke	1,565	Coke	1,525
Total Coal Equivalent		4,033		2,380
Total Coal Actual		4,033		1,525

Loss to Coal

All the heating operation, declared Mr. Flagg, might be performed with coal, but the steel maker cannot be expected to accept all the grief involved in developing such a technique, especially as fuels are available which will do the work much more easily. Inadeqaute supply may restrict gas to domestic service and need for use of oil for gasoline and ability to convert more of it into that form of fuel may make the residue more viscous and difficult to handle and burn. Should that occur, the steel maker may return to the use of coal.

Producer operators know also that for producer gas the coal must be high-volatile, uniform and have a high fusion point. A single car of poor coal will upset results several hours later. Low-fusion is necessary because the temperature must be high or the gas will not be good. From these facts it may be concluded that iron metallurgy is not a promising field for coal at present, said Mr. Flagg.

A modern fuel, declared E. C. Wagoner, Charleston, is no more modern than the equipment in which it is used. Coal to be a modern fuel must have modern burning equipment, improved producers, improved burners and better crushing equipment. "We like coal better than oil and gas," said F. K. Prosser, coal traffic manager, Norfolk & Western Ry., "and use it in our forge furnace."

A Standard Oil official had said he could hydrogenate oil for 12c. a gallon and could hydrogenate coal for half that cost, recalled Dr. Storch. So developments in commercial hydrogenation may be closer than we think. Transportation and utilization costs are what have held up coal and not production costs, declared a fourth. Not cost but quality is the first consideration in the choice of fuel for steel making or in the manufacture of any other product, added Ralph Sherman, Battelle Memorial Institute; quality, through ease of control, has caused the swing from coal to gas and oil rather than cost. The steel industry is using electricity for reduction purposes at $2.90 per million British thermal units (1c per kilowatt).

Many high-quality low-volatile coals have been ill-suited to stoker use, and attempts are being made to devise domestic stokers that will burn them, asserted Mr. Sherman. The small stoker is about seventeen years old. Every plant originally was specially designed and constructed, according to A. O. Dady, chief engineer, stoker division, Bradley Manufacturing Works. Not until the quantity demanded became great enough to generalize construction so that it could be used in any plant was real progress made, and the small domestic stoker was born. But stokers will not burn all kinds of fuel. There are five kinds of oil and three kinds of gas and each has to have its appropriate stoker, and no one probably can design a stoker to suit all kinds of coal, which is a fuel that varies more widely than gas or oil. Some coals must wait until their peculiar and difficult needs are met.

Only 8 per cent of the Federal Housing Administration houses cost over $10,000, hence one should not expect a wide sale for an expensive superstoker with bin feed, for the cost will be prohibitory for the owner of a small house. What we need, said Mr. Tobey, is "cutting and fitting research" as well as the more "high-falutin" variety.

Research Necessary

Manufacturers should themselves improve their equipment and make their own research, said C. C. Dickinson, president, National Coal Association. Automobile manufacturers had not been asked to find what oils were suitable for their automobiles or to build automobiles to utilize the oils available, countered Mr. Dady. The oil industry made the oils to suit the needs of the automobiles that the manufacturers built.

The mobile loaders and conveyors now in use in West Virginia should load 50 per cent more coal per day than they are now loading, asserted Carel Robinson, consulting mining engineer, Ward, W. Va., at the afternoon session, with G. E. Keller, chemical engineering manager, Commercial Testing & Engineering Co., in the chair. Three hundred tons per shift can be handled by even the smallest type of room conveyor now in general use. Against this capacity, the average in the New River field is less than 40 tons per shift and in the Logan County field about 50 tons. Mobile loaders in general use have a capacity to load 600 to 2,000 tons per shift, yet the average for southern West Virginia and eastern Kentucky is less than 240 tons.

Insurmountable obstacles prevent 100 per cent of the capacity of the equipment being used, conceded Mr. Robinson, but 80 per cent of the capacity fails to be attained only because of obstacles that are entirely surmountable, principal among which is the lack of skilled technical men in key positions. Those who have put reliance on such men have demonstrated what large results can be obtained.

An hour's derailment in a room a few years ago might have reduced the day's tonnage of a mine one or two tons. Today, a similar derailment would readily cause a loss of production of 50 tons. With hand loading a few years ago, headings and rooms advanced 40 to 100 ft. per month. Now, with mechanized mining, an advance of 50 ft. a day is frequently obtained: With this great increase of speed, many new needs, some still not met, have arisen—devices more quickly to detect releases of explosive gas, devices to determine more accurately the dangers from roof falls, improved communication systems, better blasting, improved maintenance, some method to reduce the quantity of dust in the mine air, etc.

Conveyors, said Mr. Robinson, work rarely at less than 70 per cent of capacity and usually up to 80 per cent, though with hand loading even 90 per cent of capacity may be attained. High capacities are possible where rooms are driven 50 ft. wide with 10-ft. pillars, which latter are not recovered.

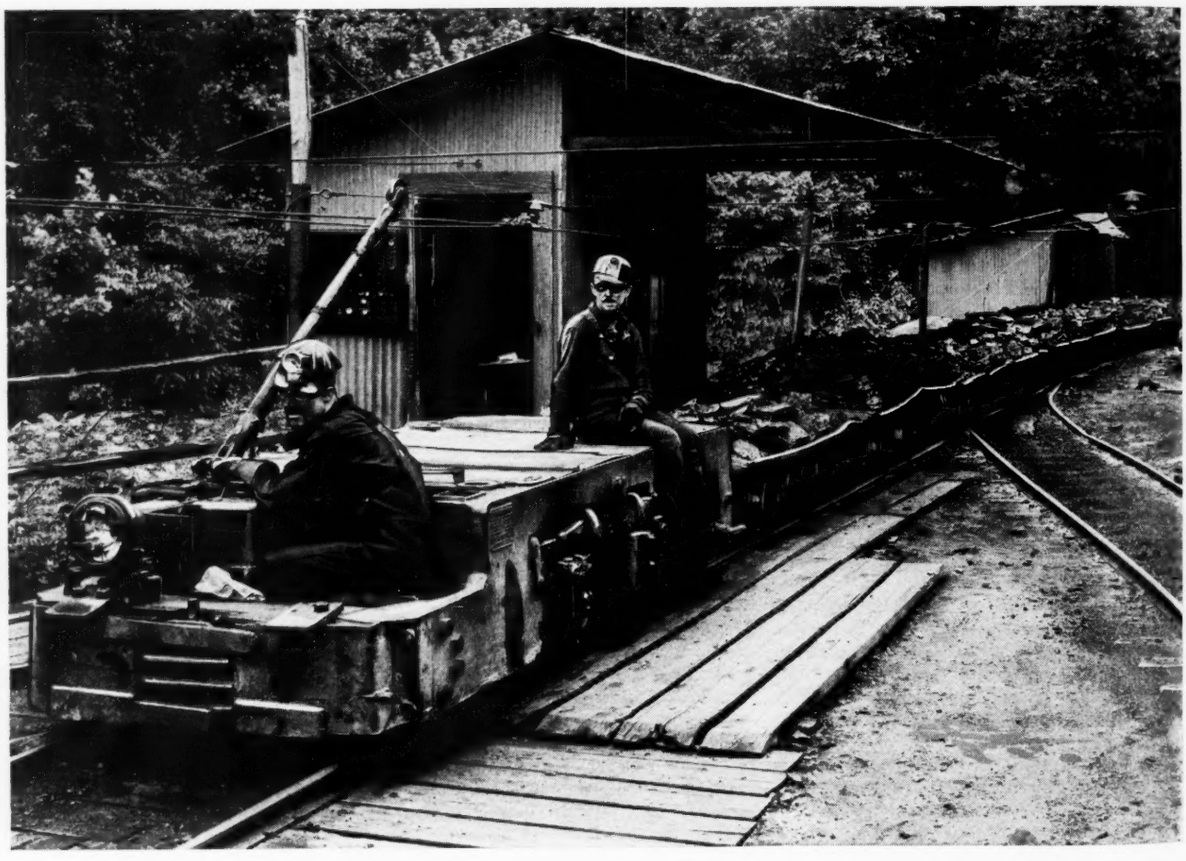
D. R. Mitchell, head of the department of mining engineering, Pennsylvania State College, Mr. Robinson said, stated last September that only 25 or 30 students in our mining schools were planning to enter the coal industry, whereas 1,200 or more students expect on graduation to engage in the petroleum industry.

Need More Engineers

In the last nine years that he has been in West Virginia University, the registration of coal mining engineers has followed the trends of business but has never been sufficient to supply the demand, declared D. L. McElroy, director, school of mines. In the last two years enrollment has increased almost 100 per cent, but is still able to fill only about one-quarter of the available jobs. The renewed demand for technical men has been largely the result of mechanization. Two or three times the number available has been called for. Mechanical and electrical engineers also are sought. As many mechanical as mining technicians are demanded. From the more elementary training departments, foremen are in demand. Starting salaries are larger, moreover, than in competing industries, and in fact there are better opportunities for technical graduates in the coal industry than in the production of oil and gas.

(Turn to page 82)

"Not a Bearing F



G-E MINE LOCOMOTIVE. The bearings in all G-E and Jeffrey Mine Locomotives in this mine are lubricated with *Texaco Marfak.*

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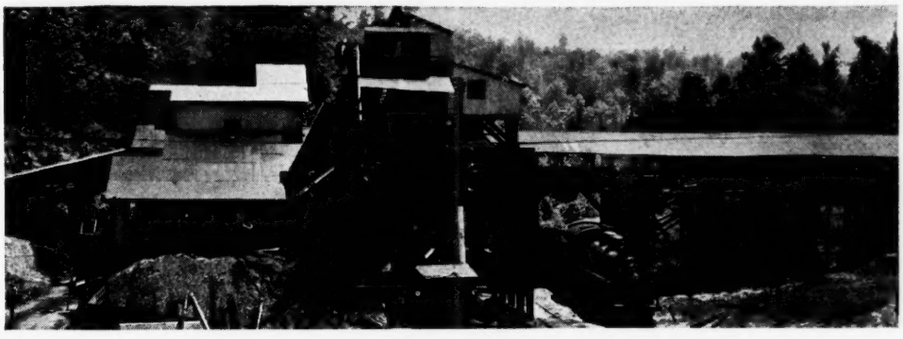

TIPPLE AND PREPARATION PLANT of the Brilliant Coal Mine, Brilliant, Alabama. For 12 years TEXACO lubricated.

Mine Lubricants

The educational authorities of the State are educating the men away from the mines, declared W. E. E. Koepler, secretary, Pocahontas Operators' Association. What is needed is the alternating method used in Cincinnati—three months in industry and three months in school.

What the industry needs is good maintenance men, declared Prof. Tolley, New River State College. The schools lean too much toward mining when training their mechanical men and not to upkeep. He thought students ought to spend alternately 4½ months in school and 4½ months in the mines. With less time they do not get habituated to either environment. A manager can save in salaries by not employing trained men but he will lose more in cost of repair parts than he will save. Whether a company is making profits is not a question, for savings from care of equipment will pay the salary of a competent man. Our men, said another, lack knowledge of machines. They should not be given a machine and then told to learn as best they may how to run it.

Growth in the use of machine loading in the various districts was reported by C. G. Ball, geologist, Chicago. The least developed field for mechanized loading lies in coal of medium thickness. Because of its economies, the big mobile loader has made marvelous progress, and in thin coal conveyors had done the same because the coal cannot be worked without them. Seams of medium thickness now have machines suited to their loading and the next few years will see marked development in them.

Studies by Appalachian Coals, Inc., said Mr. Tobey, show that 48.1 per cent of the coal used industrially for heat and power is fed to underfeed stokers, 20.8 per cent is hand fired, 16.4 per cent pulverized and 8.9 per cent is burned on chain-grate stokers with 4.6 per cent burned on overfeed stokers and 1.2 per cent on spreader stokers. In Illinois 85 per cent of the total energy requirements (excluding motor fuel) is supplied by coal; in Indiana, 87.1 per cent; in Michigan, 80.7 per cent; and in Tennessee, 68.5.

Inexpensive Stoves Needed

The low-income group, Mr. Tobey added, never can buy stokers. Its members must use hand-fired stoves, and it behooves the industry to devise inexpensive stoves that are efficient and will not cause a smoke nuisance. Already a stove has been designed that does not produce smoke. Activity in smoke-prevention campaigns is not entirely directed against coal but against faulty or obsolete equipment that does not provide for its complete combustion.

Expansion of markets for American coal in the Western Hemisphere, particularly in South America, were seen by V. C. Smith, consulting engineer, Charleston. English shipments must necessarily be curtailed, and Germany, of course, is out of the market. There is an excellent opportunity for the United States to get this tonnage and take chrome, manganese and other minerals to establish reciprocal trade. Alloy minerals are most necessary to improve our steels and maintain a competitive position.

During the World War, declared Mr. Dickinson, the coal industry was urged to expand by President Wilson. As a result, 3,000 mines were added, and after the war was over the industry had to amortize these unneeded mines. After this was done, came the NRA, which forced union operation on West Virginia. The NRA was liquidated by the Supreme Court in the course of time, but the industry has been either under regulation or threat of regulation ever since.

A recent study shows that 462 companies were reported as engaged in research in 1921; in 1927 there were 926 so reporting, and in 1938 there were 1,722. The number of employees engaged in research rose in the period from 1921 to 1938 from 9,350 to over 44,200, stated H. N. Eavenson, of Eavenson, Alford & Auchmuty. Expenditure per person engaged in research work, which includes the total number of research employees, is between $3,000 and $4,000 per year. As last year about 48,000 persons were engaged in research, expenditure probably was about $200,000,000. While in 1938, petroleum laboratories employed more than 11 per cent of the entire research personnel, their expenditures were more than five times greater than in 1927.

Generally speaking, the industries doing the most research work came through the depression with less unemployment and lower losses than those not doing it, and usually the units in each industry doing the most research work suffered less than the others. Two of the industries suffering the most were wool and coal; of all textiles, wool does the least research work and is in the worst financial condition. The attitude of most wool manufacturers was that people always wore wool and always would, but now there are several generations of Americans that wear wool only in sports clothes and not much of it then, while rayon—child of research—is growing like a rank weed. Research in coal has been insignificant and the results can be compared with those of petroleum in the same period during which a constantly reduced percentage of coal in the heat inventory of the nation has been noted.

In 1936, added Dr. Eavenson, Great Britain's coal industry was spending 2c. per ton for research; Germany in 1933 had cut its bill to about the same figure; our anthracite industry is spending more. Bituminous coal research of all kinds, including that of the Bureau of Mines, is spending not over 0.6 mill per ton and nearly all of this is government spending or money furnished by other than the coal industry, while in industry as a whole about 1½c per dollar of income is spent, which applied to coal would mean 2½c per ton. Compared with these figures, the third of a mill per ton that Bituminous Coal Research has been trying to raise is pitifully small.

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Preparation, Trucking and Underground Methods Feature Illinois Institute Meeting

STARTING off with the effect of the Illinois oil development on safe mine operation, members and guests of the Illinois Mining Institute also discussed coal preparation, underground trucking and modern underground methods at the summer meeting and 22d annual boat trip on the Mississippi River Steamer "Golden Eagle" June 7-9. The sessions also included a progress report by John E. Jones, safety director, Old Ben Coal Corporation, and chairman of the institute's committee on falls of roof, face and ribs, and the presentation of an honorary life membership to Fred Weissenborn, commissioner, Illinois Coal Operators' Association, who joined the institute in 1892, the year it was organized, and now is the only active member of that year. Presiding officers were Fred S. Pfahler, Superior Coal Co., and Roy L. Adams, Old Ben Coal Corporation.

Offering a number of examples of injuries and property damage resulting from gas and oil developments in coal-mining sections, William J. Johnson, Illinois State mine inspector, presented a plea for proper safeguarding of present and future mine workings from gas and oil wells. This requires: (1) proper location of drillholes in coal-producing areas, (2) plugging of holes, (3) use of efficient plugging methods and (4) legislation to insure accurate logging of wells so that proper plugging may be done. "The owner of the gas or oil has a right to its production—but not at the expense of the coal industry. While the laws should impose no unnecessary hardships on reputable drillers, they also should permit the Department of Mines and Minerals to keep its regulations as modern as those of the drillers." The department should be empowered to require a bond from drillers, to be returned when the well is abandoned and properly plugged. If the driller cannot supply a correct log, power should be given the department to require filling the well from top to bottom with concrete or cement. Finally, some independent agency, rather than the driller, should have the responsibility of keeping well logs to make sure that all coal measures are properly located.

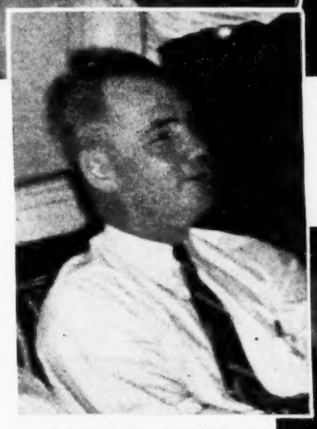
Over 6,300 wells—most of them in the Illinois coal basin—have been drilled in the recent oil development, said M. M. Leighton, director, Illinois Geological and Economic Survey. He too, expressed the opinion that logging should be done by some outside agency. Careful logging is essential to the plugging of wells, which is an important factor in safe mine operation. As a result of the adoption of a system of reporting and mapping well locations lately adopted, few unknown wells will be encountered in future coal-mine development. W. P. Young, vice-president, Crescent Mining Co., stressed the importance of location activities and called attention to the need of a better system of spotting drilling points to avoid mine hazards.

A 750-ton-per-hour McNally-Pittsburg preparation plant, said F. A. Lyons, Pyramid Coal Corporation, was built in 1939 to prepare coal from the two Pyramid mines, as well as coal purchased from others. "Installation also was made with the thought of servicing coal for others, as occasion required." Consequently, a 500-ton hopper

(Turn to page 86)

While Fred Wilkey, secretary, Illinois Coal Operators' Association, and C. W. Woosley, Pyramid Coal Corporation, talk things over, F. A. Lyons looks over the scene.

Howard Lewis, Roy L. Adams and Frank Eubanks, Old Ben Coal Corporation, take the air on the top deck.

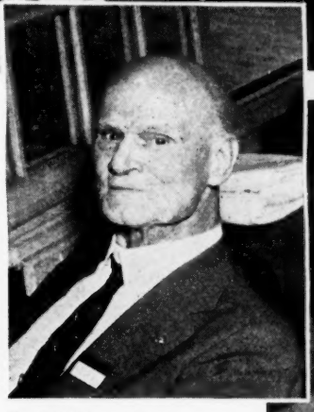


A. K. Hert, Snow Hill Coal Corporation, exchanges views with a bystander before the meeting

With his paper delivered, H. C. McCollum, Allen & Garcia Co., takes a well-earned rest.

Paul Moran, Pyramid Coal Corporation, sits one out with D. Z. Anglin and John Richmond, Truax-Traer Coal Co.

[illegible] Wentworth and C. S. DeWitt, Chicago, Wilmington & Franklin Coal Co., pose against one of Mississippi's new roller dams.



Fred Weissenborn, commissioner, Illinois Coal Operators' Association, was singled out for honorary life membership.

William J. Johnson, Illinois State Mine Inspector, relaxes from the toil of the day, with Kirk V. Cammack assisting.

A. U. Miller, U. S. Bureau of Mines, chats with W. P. Young, Bell & Zoller Coal & Mining Co.

600 Mayari R Mine Cars fo

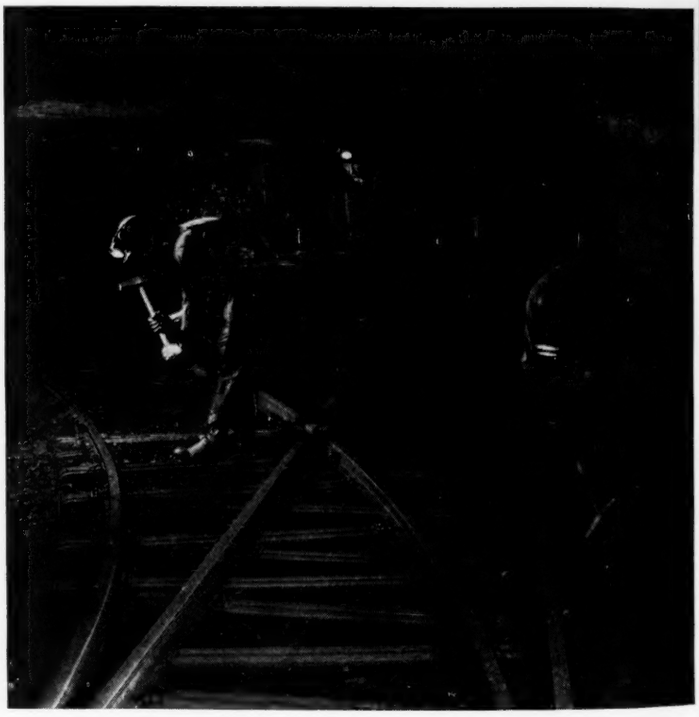
AFTER trying Mayari R plates for repair work in 1938 and 1939, Berwind-White recently specified this high-strength, corrosion-resisting steel for 600 new mine cars. In addition to Berwind-White many other progressive mining companies are using hundreds of Mayari R cars to cut replacement costs and increase hauling efficiency.

Mayari R has from 30% to 50% greater abrasion resistance and from 5 to 6 times the atmospheric corrosion resistance of ordinary carbon steel. And because of its greater strength Mayari R in many cases permits the use of lighter sections to reduce dead-weight. The finished-job cost is practically equal to that of ordinary steel and considering its longer life and lower maintenance Mayari R affords worthwhile savings to any operator large or small.

Mayari R comes in all of the usual forms: structural shapes, plates, bars, sheets, strip, nuts and bolts, rivets and cold-formed sections.

Purple Strand Hoist Ropes give outstanding service on 32-yd. shovels—Bethlehem's Purple Strand Hoist Ropes have done an outstanding job on 32 cu. yd. stripping shovels as well as smaller shovels operated by many surface mining operators. These 2⅛-in. I.W.R.C. ropes have given a consistently good performance in as gruelling a test as a surface-mining hoist rope can undergo.

Bethlehem's recent million dollar mill improvement program includes special manufacturing equipment and new precision methods that make possible ropes of uniformly high quality. Among Bethlehem's special ropes for the coal industry are: shaft-hoist ropes—slope and incline ropes—mining machine feed ropes—loader, slusher and tugger-hoist ropes—haulage ropes and coal conveyor ropes.



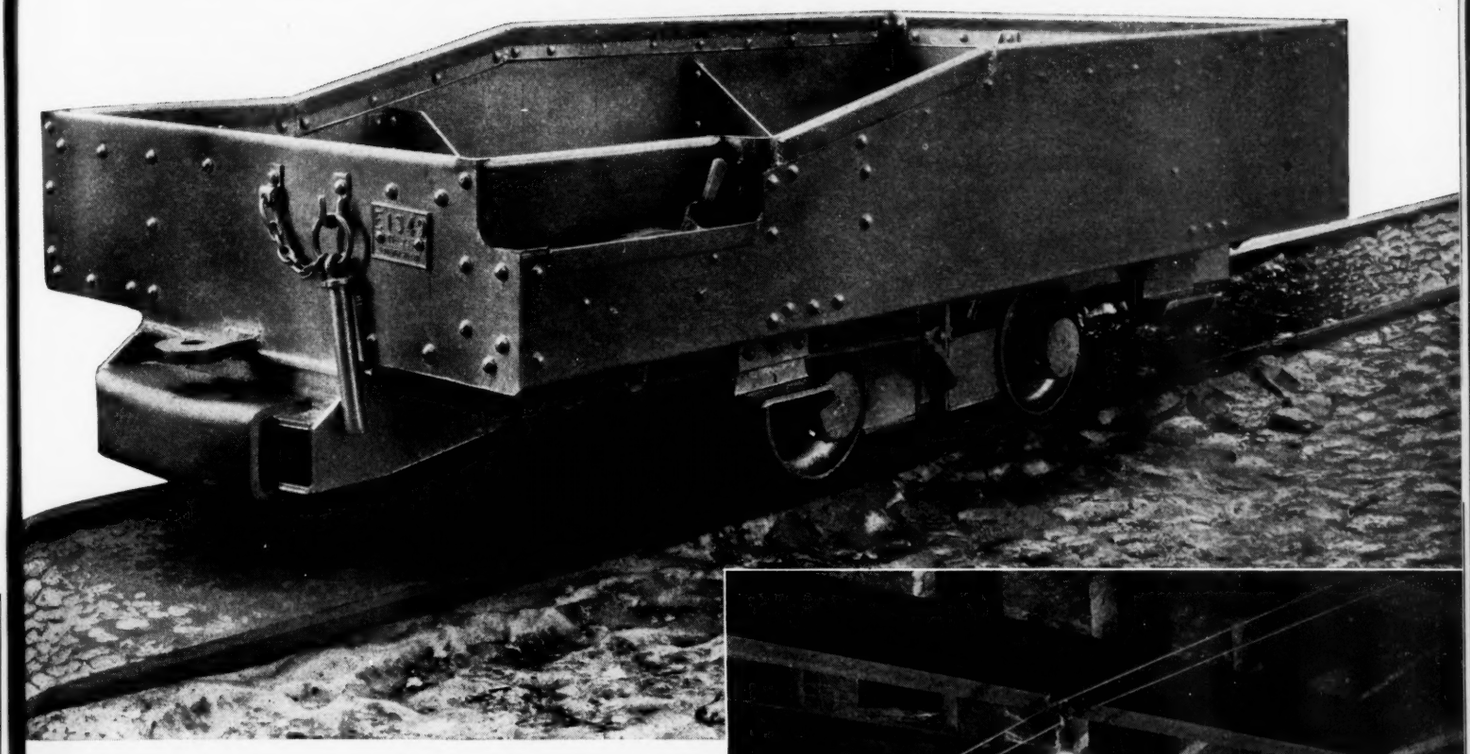
Installation and recovery costs cut in half with Bethlehem ties—Coal operators using Bethlehem steel mine ties have found their installation and recovery cost to be as low as seven cents per tie. This is about half the cost of pulling and relaying the average wooden mine tie. Furthermore, Bethlehem ties are usually good for about 20 installations while wood ties rarely stand more than 4 before they are spike-killed.

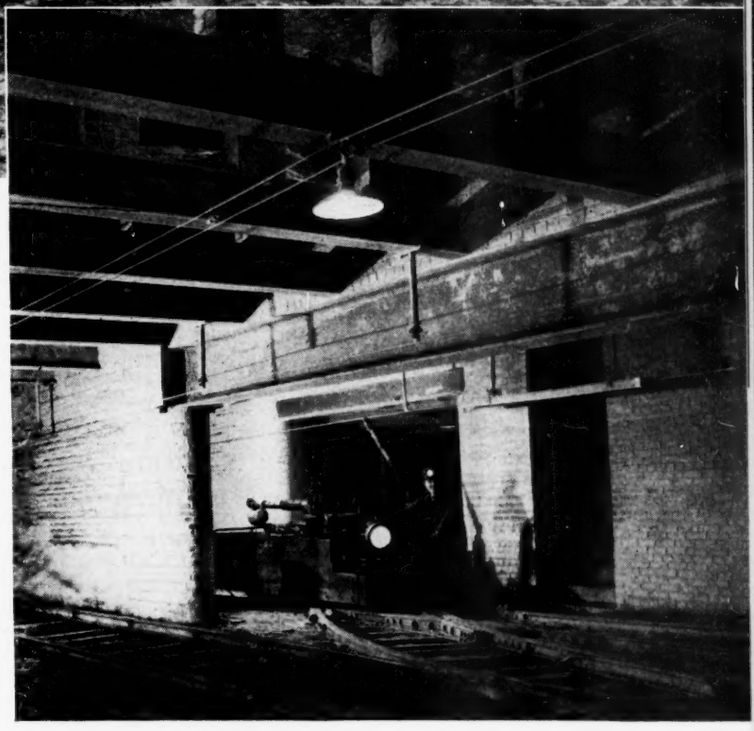
Bethlehem ties require no gaging or tie rods. Steel clips, permanently fastened to the tie hold the rails firmly. One or two hammer blows lock the clip to the rail. Mine track goes in faster and stays safer.

Bethlehem Products for the Mining Industry: Rails . . . Steel Ties . . . Frogs, Switches, Switch Stands, Turnouts and Special Trackwork . . . Track Bolts, Nuts, Spikes . . . Mine Cars . . . Wheels, Axles . . . Bars, Plates, Structural Shapes . . . Steel Construction . . . Steel Timbering . . . Pipe, Boiler Tubes . . . Galvanized Roofing, Siding . . . Wire, Nails, Fence . . . Wire Rope, Strand . . . Drill Steel . . . Forgings . . . Castings . . . Pig Iron.

BETHLEHEM STEEL

Berwind-White Coal Mining Co.

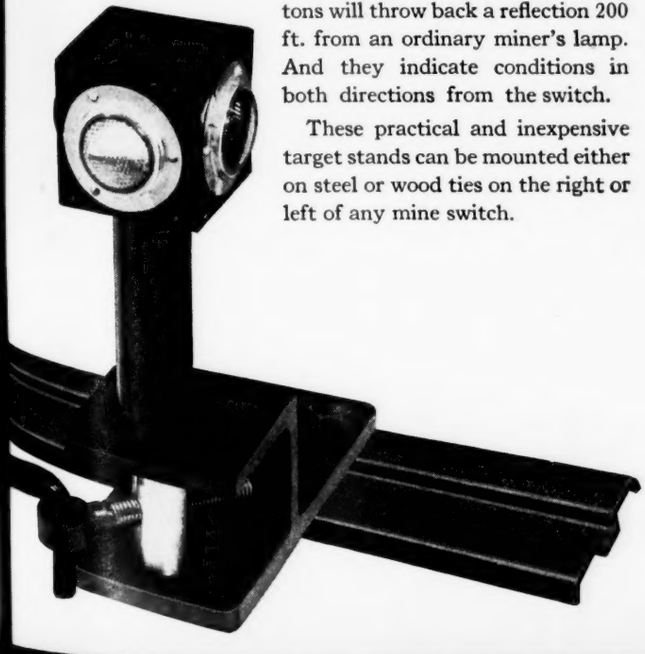




Bethlehem Mine Target Stands for increased safety—Bethlehem mine target stands are entirely mechanical. There are no complicated parts or electric wiring to get out of order. They operate from the switch rod rather than the switch stand and give a true indication of switch conditions.

Their red and green reflector buttons will throw back a reflection 200 ft. from an ordinary miner's lamp. And they indicate conditions in both directions from the switch.

These practical and inexpensive target stands can be mounted either on steel or wood ties on the right or left of any mine switch.



Bethlehem steel timbering in Ellsworth, Pa., mines—Bethlehem wide-flange beams in 4-, 6-, 8-, 10- and 12-in. sections are used as cross bars in the haulages and butt entries at the Industrial Collieries Corporation mines, Ellsworth, Pa. Bethlehem steel shapes are also used as hitch timbers or dead logs in the shafts.

An increasing number of operators are using this modern method of mine support in main haulage ways. They have found that Bethlehem wide-flange shapes are more economical for this purpose than are the commonly used steel rails; in some sizes these beams have twice the load bearing capacity of steel rails of a comparable weight.

Bethlehem regularly rolls steel shapes in a complete range of sizes suitable for all timbering.

BETHLEHEM STEEL COMPANY

was installed to receive coal from mine cars and coal shipped in by rail. The latter is dumped by a Link-Belt rotary railroad-car dumper. The bin insures a steady flow of coal through the plant at all times, and is supplemented by a remotely controlled adjustable-speed feeder and an adjustable double-roll breaker permitting breaking to a predetermined lump size ranging from 7 to 18 in. or reduction of the entire feed to minus 7 in.

Lump, when made, is hand picked, with laminated pickings going to a middlings crusher for reduction and recirculation to the plant feed. This crusher also may be used for breaking down oversize when operating on a minus 7-in. basis. Coal under 7 in. is cleaned in three McNally-Norton automatic washers—one for 7x4, one for 4x1¼, and the third for minus 1¼. The latter is screened to 1¼x¾, ¾x⅜ and minus ⅜. The minus ⅜ is dewatered on high-speed shaking screens, where minus ½-mm. is removed and pumped with the water to a settling cone. Clarified water returns by gravity to the fine-coal washer. "This settling provides the higher degree of clarification necessary for the fine-coal washing.

Secondary rejects from the egg and nut washers are crushed to minus 1¼ in. and recirculated. Washed coal from both boxes goes onto classifying screens which size it and take out the minus 1¼-in. degradation. The latter flows with the water to a steel settling tank with drag conveyor for removing the coal preparatory to routing it to the fine-coal classifying screens for final sizing with the rest of the 1¼-in. washed coal. Water from the settling tank is pumped back to the egg and nut washers.

"In this manner, we have a split water-circulation system. This arrangement greatly reduces the volume of water passing over the dewatering screens and provides a much more favorable coal and water ratio than if the wash water of the entire plant had to pass over the screens . . . which would require double the screens now in use. Furthermore, splitting the water system makes it possible to locate the pump sump for the coarse-coal washers above the track clearance, greatly reducing the head and saving power."

Provide Dust Allayers

Mixing equipment is provided for all sizes, with facilities for running any size over ⅜ in. to a primary stoker-coal crusher, followed by a vibrating screen and a secondary stoker crusher, supplemented by a three-deck vibrating screen at the head of the fine-coal classifying screens. Degradation screens are placed in each classified-coal chute, breakage going to the secondary stoker crusher. Automatic equipment for oil treating also is installed at each chute. A vibrating calcium-chloride feeder, which may be set to feed automatically any number of pounds per ton, is installed over the mixing conveyor.

Shuttle-car operation in 5- to 5½-ft. coal in the Springfield (Ill.) district was discussed by H. C. McCollum, Allen & Garcia Co. Horsebacks are frequent and the mining system is based on 24-ft. rooms on 36-ft. centers with approximately 230 ft. of cover. The first shuttle car went into service in December, 1939. Cars, powered by batteries, hold approximately 4½ tons. Two cars serve each crawler-mounted loading machine. Use of the cars, Mr. McCollum stated, "can effect a saving in labor of five men per loading-machine unit . . . In addition to the labor savings in this one installation are the increased tons per loading-machine unit, decrease in deadwork usually necessary on account of horsebacks, reduction in room territory formerly required because of trackwork, elimination of all track materials and, finally, less timbering."

In one mine, said James H. Fletcher, consulting engineer, installation of rubber-tired haulage behind loading machines cut the number of 5-ton mine cars in service from 78 to 28. Formation of dust due to tires grinding up coal, thought John E. Jones, could be met by using the shuttle cars as rock-dust distributors, placing the dust on the floor where passage of units on operating days would spread the rock dust around. Three companies, observed Walter Jones, Joy Mfg. Co., already are following this system. Adjustment of tire pressure and use of as smooth a tread as possible, stated Mr. Fletcher, will go far toward reducing coal breakage on the floor.

Modern Methods Canvassed

With Talleydale No. 3 mine supplying material for examples, A. K. Hert, general superintendent, Snow Hill Coal Corporation, Terre Haute, Ind., offered a number of observations on "Modern Underground Methods." Mining the No. 3 seam, averaging 6 ft. in thickness, the company recognized that the 20 to 25 per cent of high-ash high-sulphur refuse would have to be removed by an efficient coal-cleaning plant and that securing costs comparable with those of competitive operations would require the most up-to-date type of mechanical mining.

Two rock or pyrite partings and numerous sulphur lenses and balls occur in the seam, which makes undercutting, using track-mounted equipment, a major problem. Production per point is only 0.8 ton and labor cost for cutting is 20 per cent higher than the labor cost of loader operation. Maximum efficiency in cutting dictated the use of track-mounted equipment with its superior tramming ability.

"High capacity and high efficiency in loading are vital due to the unusually high percentage of refuse passed through the transportation system and the washery to the refuse pile. We recognize four major factors influencing loading-machine performance. Stated in the order of their relative importance they are: (1) Management, (2) face preparation, (3) car change and (4) roof control.

"Mediocre equipment with good management has a much better chance of success than good equipment with mediocre management. If the other factors affecting mechanization are properly organized, the importance of face preparation is emphasized, as the speed with which coal can be picked up will have a marked effect on performance." Good progress has been made at Talleydale, but, notwithstanding, "reference to our time studies and observation of loading machines in action show a great deal of time consumed in digging down the coal."

Car change involves several factors, including car size. Talleydale cars hold 5.8 tons and were considered big when installed in 1935. Regardless of the size of the mine car, its performance will be dependent upon the track layout. Most track systems, unfortunately, are a compromise between what would be the most efficient and what old track material is available at the mine. "It seems absurd to spend huge sums for intricate machinery and then fail to give due consideration to the importance of the track system."

Talleydale uses 40-lb. rails uniformly 15 ft. long. All frog and switch material is the same and the supply is unlimited. "Our tracklayers work efficiently because they are supplied with the proper materials. We have worked out a room-track system which facilitates car-changing and provides storage capacity for empty and loaded cars." One 6- or 8-ton cable-reel locomotive serves a loading machine, with one swing locomotive to each two gathering locomotives. "Our haulage facilities are readily capable of changing 140 cars per 7-hour shift under the prevailing conditions."

Timbering close to the face is a necessity at Talleydale, and "the track machine which we use is designed to maneuver successfully under these conditions. We consider this a very important factor."

Six complete units and one development unit with a five-man crew are operated at Talleydale. The standard crew averages 17½ men. "During May, the six fully manned units averaged 584.4 tons of raw coal per 7-hour shift. The average number of cars loaded by these units was 103.8 per shift." A time study made one day in this period showed, in the case of the low-production machine, that 58.1 per cent of its time was spent in loading; car changing, 18.6 per cent; tramming, 9.8 per ceent, and delays, 13.5 per cent. Production was 551 gross tons from 14 places, making the loading rate 2.27 tons per minute. Total tramming distance was 5,625 ft. On the same day, the high-production machine loaded 736.6 tons from 17 places, spending 63.6 per cent of the shift in this operation. Car changing took up 19.2 per cent, tramming 8 per cent, and delays, 9.2 per cent. Loading rate was 2.85 tons per minute and total distance trammed was 3,732 ft.

A 40-room panel at Talleydale, commented Morris Cunningham, Goodman Mfg. Co., is operated with only 50 to 60 turnouts. Where shaft dimensions are a limiting factor, large cars can be used between the face and a transfer station, thus providing the advantages of larger-capacity equipment behind the loader. At Kings Station mine (Princeton Mining Co.), as an example, approximately 500,000 tons will be handled through one such station.

Smoke Ordinance Considered

The new St. Louis smoke ordinance and a brief summary of work being done to reduce smoke in the combustion of Illinois coal were the concluding events on the program. Joseph E. Hitt, Walter Bledsoe & Co., urged the institute to lend its aid in securing a change in the law to prevent widespread damage to Illinois mines.

A study of briquetting Illinois coal was begun in 1931, stated Dr. Leighton. Initial work showed that briquets could be made without a binder. Study of the possibilities of making smokeless briquets showed that

in some cases a smokeless briquet could be made with the coal at room temperature, while with other Illinois coals it was necessary to heat them to as much as 470 deg. C. to drive off the volatile matter. In either case, the resultant briquet has a smoke index equal to or less than Pocahontas coal. The Illinois Geological and Economic Survey now is building a briquetting machine to test out the possibilitis of commercial production. With time, declared Dr. Leighton, it is expected that Illinois coal can be burned smokelessly in all types of equipment, including stoves. Successful production of smokeless briquets will not only solve the St. Louis problem but also will enable Illinois coal to expand in other markets.

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British and American Mining Methods Compared At Mining Electrical Group Session

FOREIGN mining methods, with special reference to the coal industry in England, Scotland and Wales, described in a paper by Arthur F. Belding, manager of the London office of Sullivan Machinery Co., provided the chief topic at the monthly meeting of the Southern Illinois Mining Electrical Group, June 14, at West Frankfort.

In England, said Mr. Belding, there are three coal fields: the Newcastle, Yorkshire and Lancashire, and, to the south, the Midland field around Nottingham. In Scotland, coal is in the lowland area from Ayrshire to Fifeshire, where is located the Fife Coal Co., one of the largest in Great Britain. This is all bituminous coal.

The principal coal field of Wales, around Cardiff, is said to have the highest B.t.u. content of any bituminous coal. Comparable to West Virginia Pocahontas coal, it was used largely by the British Navy before the introduction of oil. Welsh coal is exported to many countries having no coal of their own. There is a small production of anthracite coal in Wales, which is largely exported to Canada, but is practically unknown as a domestic fuel in Great Britain.

Mr. Belding pointed out that bituminous coal is mostly used for cooking and domestic heating, and that large lump burned in open fireplaces is favored for its genial comfort and as an aid to ventilation. Central heating has made some progress in the cities but is not favored in country areas.

Overburden Heavy in Britain

British coal deposits, Mr. Belding stated, are superior in quality to those of many other European countries, but conditions for mining are not as favorable as in the United States. The veins run from 16 in. to 5 ft. thick and average 3 ft., with average overburden estimated at three times that in the United States. In several British coal fields the cover is 3,000 ft. or more. Most of the mines are gassy and safety lamps must be used. The heavy overburden and the unfavorable roof conditions have much to do with the mining methods used.

Two methods of mining are used, the customary longwall, hand or mechanized, for general application, and the checkerboard system for areas where subsidence must be prevented. In the first, all the coal is removed. In the second, huge pillars leave more coal in place than we leave by our not too scientific methods in America—called pillar and stall mining. Both advancing and retreating methods are used.

An average single longwall face is 100 to 150 yd. long, and customary development for machine mining is to work two such faces in line, with a "mother gate," or main entry, dividing the two, and a "tail gate," or auxiliary entry, at the outer end of each, to provide a continuous working face 200 to 300 yd. long. Should these blocks of coal be hand mined, a series of intermediate gates at 10- or 12-yd. intervals are driven through to the working face.

Such a typical double-longwall face is operated in cycles of three shifts, using two undercutters, one on each side of the mother gate. The first shift undercuts the coal, cleans out the cuttings, or "holings," sets a row of props, drills a series of holes along the roof and shoots the coal. The second shift loads, or "fills" out, the coal. The third shift brushes the roof, sets a fresh row of props, moves the conveyor over into the new lane, arranges the cutting machine for the reversing cut and does any necessary odd jobs. The normal undercutting kerf is 5 in. unless roof or pavement (bottom) conditions require it to be greater; then it is made 7 in. Mine timbers are all imported from Scandinavia, since Britain has none.

Undercutting Gains Slowly

Mechanization, as we in America understand it, began in Great Britain in the 80's with the introduction of the coal cutter, but progressed slowly. By 1911 only 11 per cent of British coal was undercut. Early undercutters were of two types. The disk machine, in which the cutting element was similar to a circular saw laid down flat, with double- and single-prong cutter bits, found special use in cutting the pavement under thin seams, and is still used to some extent. Its huge size and clumsiness fitted it poorly for normal conditions. Its undercut was about 4½ ft.

The bar machine may be visualized by substituting for the cutter of our standard track machine a rotating bar sticking straight out in front and arranged to swing through an arc of 180 deg. in a horizontal plane. The bar is tapered from 8 to 3 in. in diameter. Bits are wedged into holes drilled in this bar. Chain machines, both American and British, are now displacing old type undercutters.

Mr. Belding began the introduction of Sullivan longwall chain undercutters in 1912, and through 28 years of contact has become familiar with British mining conditions and practices. Commenting on the Cincinnati show of the American Mining Congress this year, he said: "It would be impossible to get most of the cutting and loading equipment exhibited at Cincinnati underground in British mines, much less use it there." The average over-all dimensions of a suitable longwall undercutter is 7½ ft. long, not more than 30 in. wide and 16 or 18 in. high. A certain type machine is but 12 in. high and will pass a line of props set 30 in. from the face.

Due to roof conditions, the use of conventional type loading machines is impossible. In certain areas government regulations require props within 4 ft. of the face, and the roof may have to be "strapped" by setting a plank on top of the prop at right angles to the face, with the coal notched to carry the end. A new prop must be set immediately after the undercutter has passed to compensate for loss of coal support. Loading is done with long-face conveyors of various types into which coal is shoveled by hand, or by scraper loading, similar to that used here, as introduced into Great Britain by Mr. Belding. Belt conveyors seem to be preferred, especially for long faces and for heavy tonnages.

Fillers (loaders) are used with scraper conveyors to push the coal from the face into the line of travel of the scraper. Because this is easier work than lifting coal into conveyors, the scraper loader is popular with fillers.

Small Cars Dominate

"Wagons," or "tubs," holding 1,120 lb. on 24-in. gage lightweight track, often not fishplated, are used to transport coal to the shaft. Some of the larger and more progressive pits are going to heavier track and larger wagons. Haulageways are being made more permanent by the use of heavy steel supporting arches. While storage-battery and diesel locomotives are being introduced, the customary haulage is endless-rope. Bare trolley wires are not permitted, which rules out trolley locomotives. Gaging is by hand, as also is the dumping on top. Electric hoists, or "winders," are becoming standard equipment.

Underground power is largely supplied by compressed air. There is one central compressed-air power plant in Wales having five 40,000-cu.ft.-capacity air compressors, which supply through 28-in. pipe lines as far as seven miles to various mines. The pipe line is electric welded. It is asserted that this is, possibly, the most efficient air plant in the world.

British coal operators have gone far in the preparation of coal for market. Mr. Belding is of opinion they have invested more money for washing and grading coal, in comparison to production, than any other country. Many of their preparation ideas are being used in our American plants.

About 1928, the British Government decided to substitute 500-volt 3-phase 50-cycle standard electric power in the mines for the miscellaneous mixture of a.c. and d.c. voltages and a wide range of a.c. frequencies. A ground wire is carried to all services, which reduces the hazard to men. Several large central stations were built and many old ones scrapped. This work was carried out through the Central Electricity Board, a semi-public body, financed by the public with a governmental guarantee of interest payments.

The salable production of Great Britain's coal averages about 230,000,000 tons per year while peak exports ran to about 80,000,000 tons per year. The industry has a

central selling set-up, imposed by the government, with fixed prices and production quotas for individual mines. Many mines operate 250 days per year. Royalties must be paid on coal whether mined or not. Coal sells at the pithead for $3.15 to $3.60 per ton, but, even with the short rail haul, the London householder pays around $9 to $10 per gross ton. The Government Mines Department issues quarterly reports giving output by districts, segregated costs of production, proceeds from sales, royalties and profit or loss. These reports are available to the public.

Production per worker is low compared to that in America. The average is 18 or 19 hundredweight per man, equivalent to a little more than our short ton. The coal miner usually has a free house and free coal. Living costs are low, so he lives better than his average daily wage of about $2.50 would indicate to us. Skilled workers earn more. By the rating of the conscription board during the World War, coal miners' physical conditions stood A-1, while cotton-mill workers were largely graded down to C-3, a fine tribute to the general health of the coal miner.

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Safety and Mining Thin Coal Mechanically Themes of Indiana Institute Meeting

LEADING off with the section foreman's views on safe coal production and winding up with a discussion of available thin-coal reserves in Indiana and methods of mining them mechanically, members of the Indiana Coal Mining Institute met in their 1940 summer conclave May 18 at the Hotel McCurdy, Evansville, Ind. The gavel was wielded at the technical session by Institute President R. H. Templeton, vice-president, Templeton Coal Co., Sullivan, Ind.

Safety-mindedness is an essential characteristic in a successful foreman, declared Herald Cazzell, Knox Consolidated Coal Corporation, Bicknell, Ind., in opening the discussion of the section foreman's viewpoint on safety in coal production. Therefore, the foreman must not talk safety to his men and indulge in unsafe practices himself. "If he does, his men will be quick to resent it, and the result will be a general let-down in discipline.

"Safety is a subject that must be kept constantly in the foreground of the minds of the men at work. To do this, the foreman must devise various ways and means. He must be careful not to let the subject become tiresome. He must study the personality of the various individuals under him and be quick to catch the reactions of each man to the different rules which he may put forth from time to time. The foreman must keep a constant check on all machines and locomotives on his section. Thus, he will avoid accidents caused by faulty machinery. All safety devices must be kept in proper working order, as the workman otherwise will be quick to resent having to operate the equipment.

"Haulage roads must be kept clean, and all switches in proper working order. Roof over the haulage road should be inspected regularly by the foreman. This should be done, if possible, while the motormen are pulling coal. It will give them confidence and let them know their safety is being considered, as they have very little time themselves to do this inspecting. Lights along the haulage road are very important to the safety of the men engaged in hauling coal. These also make it easy for the other workmen to see moving trips. Plenty of lights will be especially valuable on hilly sections where hitchings are likely to break or drawbars pull out, causing runaway trips.

"All workmen, such as cutting-machine men, drillers, tracklayers, timbermen, etc., must practice throwing switches to lead the cars away or placing some obstruction on the track for their safety. Motormen and tripriders must be taught never to stand between motors or cars when they are on partings or bottom; never to couple on the bump; never to get off a moving motor or cars directly in front. All of these rules will be observed by the men when enforced by the foreman in the proper manner.

"Loading coal with machines can be done safely by close cooperation between the foreman and the loading-machine operator. First, the foreman must examine the roof himself. When a dangerous condition exists, he should discuss this with the operator and agree on a safe method of loading the place. Certain safety rules must be observed in this process. First, never knock a timber until another has been set in its place to support the roof. Always keep the operator within the timber line. In doing this, he must always pass the timber between his body and the machine, and never try to squeeze his body between the machine and timber. If the foreman will examine places plenty of time before loading, he will have timbers all ready cut and prepared, and very little time will be lost.

"Sprinkling the coal ahead of the loading operation will enable the operator and foreman to see plainly at all times. Besides, sprinkling adds to the general health of the loading crew and keeps them in better spirits.

"These are only a few basic rules and much can be added to them to meet differing conditions. The foreman must have ability to meet the ever changing conditions, plus the initiative to put into effect the various changes necessary to be made. The foreman *must* be a good salesman. I stress this point because much depends on his ability to get new ideas quickly across to the men under his supervision. Getting the proper reaction to safety rules will depend on keeping the men in the proper frame of mind. Once a workman becomes entirely safety-minded, he automatically will do his work in a safe manner when taught the safe method to use.

"By discussing first-aid and accident-prevention with the men in his section the foreman will encourage them to put forward their ideas. By being courteous and giving the proper attention to these ideas and entering into a frank discussion of their merits, he will find the results highly satisfactory. When an accident occurs, it should be discussed and the way to prevent it should be established, if possible, as well as the method of first-aid to the injured one. Too much stress cannot be laid on proper treatment after an injury, which may have as a result the life or death or permanent impairment of the injured.

"The foreman should note the condition of the clothing worn by his men. They must be encouraged to wear good safety shoes and hats and to keep their other clothing in a good state of repair, as torn or ragged garments always are a hazard and safety shoes without good soles are dangerous.

"To get safety results, the foreman must be thinking constantly. Also, he must keep his men thinking. Most people are mentally lazy and do not like to think. Therefore, it is the foreman's job to keep them at it. His success or failure will depend on this."

The safety atmosphere, contended Fred Ferguson, chief mine inspector for Indiana, must pervade the entire surroundings of a mining operation. Another vital factor is the ability of the foreman to sell safety ideas to the mine employees. In some States where layoffs are given for violations of safety rules, these layoffs are used as opportunities for continuing missionary work through the medium of letters addressed to the rule violators at their homes. Such letters explain the reasons for the layoffs and naturally make deeper impressions than oral arguments, which tend to become monotonous from constant repetition and therefore not highly regarded, whereas letters are read and reread and thus their contents have that much greater chance of sinking in. With a letter, also, there is much less opportunity for misunderstanding. A man's mood or attitude at the time of an oral communication may be such that an unfavorable impression is created, whereas when the mood passes, the letter, which may be reread, may obtain the desired results. A written message also is read by other members of the family, who help to influence the addressee. And "by writing a man at his home you may unconsciously remove the barrier that may exist between the foreman and the employee."

Careful Study Imperative

A company earnestly attempting to reduce injuries, said Mr. Ferguson, must base its safety program on a comprehensive study of policies, practices, equipment and personnel. Safety programs have been known to fail because company policies were inadequate or were ruled by expediency, because foremen were confused by failure to definitely allocate authority and responsibility or because the policies were not explained to employees in easily understood language. Finally, "the effectiveness of a safety program is in direct proportion to the interest, support and leadership of the mine management."

Training the employee to do the right thing at the right time is the most effective single factor in safety. "The first step should be a more thorough training of foremen in

Safety advocates

Herald Cazzell, section foreman, Knox Consolidated Coal Corporation; Fred Ferguson, chief mine inspector for Indiana, and James Reilly, section foreman, Snow Hill Coal Corporation, discuss the section foreman's place in safety work.

Keeping the ball rolling

Jack Ogilvie, Lynch Coal Operators' Reciprocal Association, lends a hand with the organization of the meeting.

Reports on thin-coal round-up

R. W. Karpinski, Indiana State Teachers' College details thin-seam possibilities in Indiana.

Princeton Mining Co. representatives include those shown here.

These nine and others represented Dresser mine.

Part of the Saxton group

T. L. Durham, H. C. Bean, Hugh Waugh and K. O. Kisher help represent Saxton mine.

Helps represent Peabody

James White, superintendent, waits for the session to start.

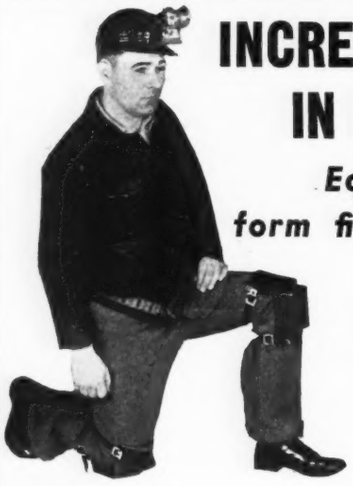
All set for the discussion

William Cunningham, Linton-Summit Coal Co., and Andrew Hyslop, Sr., Snow Hill Coal Corporation, are ready.

The Binkley delegation was headed by Mack Moss, superintendent.

Pre-meeting confab

Peb G. Conrad, Knox Consolidated Coal Corporation; James Hyslop, Walter Bledsoe & Co., and C. A. Herbert, U. S. Bureau of Mines, talk matters over.



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teaching methods. In the past, the instruction of employees by foremen has been neglected for several reasons," such as assumption by the foreman that the men already have been trained, lack of ability on the part of the foreman to impart instruction with consequent reluctance to tackle the job, and a feeling on the part of some foremen that attempts to give instruction would be resented by the men. "Many foremen and superintendents have overlooked a real opportunity for effective work in this field. Correction and instruction of employees will not only increase production and decrease injuries but also will have a salutary effect on the thinking and actions of other workers."

There is no question that if the section foreman is not safety-minded there will be no safety in his section, declared James Reilly, section foreman, Snow Hill Coal Corporation, Terre Haute, Ind. And to secure safety, one must keep constantly at it. Commenting on certain points brought out by Mr. Cazzell, Mr. Reilly made the point that the way to keep a mine clean is to clean it as you go. Lighting is an important item, and on working sections at Snow Hill, in addition to other mine lighting, a light is placed at every key room, as well as lights at every fifth or sixth of the worked-out rooms behind. New locomotive headlights of the non-blinding type, while costing about twice as much, soon return the extra outlay in savings in bulbs, in addition to providing a superior illumination.

Safety is the responsibility of everybody in the coal industry instead of largely the section foreman's, even though he is a vital factor. Manufacturers also owe it to themselves and to the industry, he intimated, to make sure that equipment design provides the maximum in both safety and comfort.

Cites Problems of Future

The next few years will bring the industry up against the problem of men to replace those now operating fast-moving equipment, declared Mr. Reilly, inasmuch as few young men now are being trained in these tasks. So it behooves operating companies to begin now to induce young men to enter the mines and to make sure that they receive proper training when they do start to work, particularly from the standpoint of safe working habits.

Echoing Mr. Reilly's points on recruiting and training young men, C. A. Herbert, chief supervising engineer, Vincennes (Ind.) station, U. S. Bureau of Mines, cited the work of Stag Canon Branch, Phelps Dodge Corporation, Dawson, N. M., which maintains a special training section in the mine. The problem, in Mr. Herbert's opinion, is one which must be faced now.

As a start on a survey of the thin-coal reserves of Indiana which might be worked mechanically, Dr. R. W. Karpinski, head, geology and geography department, Indiana State Teachers' College, Terre Haute, Ind., offered some preliminary findings on the acreage of coal between 3 and 4½ ft. in the various coal-bearing counties of the State. No estimate of total reserves of such coal was presented, inasmuch as investigation still is under way, although a number of

individual acreages in the several counties were detailed.

In closing his paper, Dr. Karpinski called attention to the fact that additional funds for survey and research work undoubtedly would yield very worth-while results. The institute concurred to the extent of passing unanimously a resolution that the need for more money be presented to the State Legislature.

Methods of mining thin coal mechanically followed and gave point to Dr. Karpinski's observations on reserves. With A. S. Knoizen, vice-president, officiating, the Joy Mfg. Co. presented a motion picture showing the mining of thin seams under varying conditions with both conveyor and shuttle-car transportation behind caterpillar-mounted loading machines. This was followed by a motion picture dealing with thin-coal extraction by means of shaker conveyors fitted with automatic self-loading duckbills, presented by Morris Cunningham, Goodman Mfg. Co.

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State Officials Join Producers in Opposing U.M.W. on Mine Inspection Bill

STATE officials, mine inspectors and coal producers lined up solidly against the Neely-Keller mine inspection bill, sponsored by the United Mine Workers, at hearings before the House Subcommittee on Mines and Mining, which were concluded at Washington on June 14. Sessions, which began on May 16, were held three days a week. Besides Representative Keller, sponsor of the bill in the House, who spoke for 40 minutes in its favor, it was supported by Representative Jennings Randolph of West Virginia, Thomas Kennedy, international secretary-treasurer of the U.M.W., and a number of State miners' union officials.

The measure would hurt rather than help the cause of accident prevention and mine safety, declared John D. Battle, executive secretary of the National Coal Association, testifying on June 4. He charged that the bill was a political maneuver designed to take the supervision of coal-mining operations out of the hands of State agencies and set up federalized bureaucratic control. "We assert that the purported objective of mine safety is sham and false pretense," said Mr. Battle, "and that its effect would be to impair existing mine-inspection agencies and mine safety measures as well as to impede coal-mining operations to the detriment of the mine workers, mine management and the consuming public.

"Federal policing of coal-mine operations is wrong in principle, and as a practical matter when a Federal agency and a State agency have concurrent jurisdiction, as is contemplated by this bill, the Federal agency, under present-day government policies, comes out on top.

Accident Ratio Recedes

"*The bill will not promote mine safety. It will not prevent mine accidents.* It ignores the fact that under the existing set-up the U. S. Bureau of Mines, State laws and regulations governing mining, State inspection and safety agencies, and with whole-hearted cooperation of mine operators, the accident ratio has steadily diminished, and mining operations as respects safety have steadily advanced.

"Despite all its pretended 'cooperation with the States,' the pending bill is the initial step in a perfectly obvious plan for superseding State mining laws and State mining safety agencies with Federal standards, Federal mandates and, through the guise of safety, Federal regulation of mine management from first to last. The proponents ignore the fact that uniformity of mine safety laws on a nationwide basis is inherently impossible because of the vastly different natural conditions existing in the occurrence of coal in the various coal regions. The regulations applying to mines in one State will not be even remotely applicable to those in another State. The present set-up of State inspection department police power over the mines within the State is far more flexible and more sensible than to have all such activities emanating from a Federal bureaucracy in Washington."

Cost Feature Ignored

Mr. Battle pointed out that the bill contained no limit of cost and asserted that proponents had offered no estimates and resisted efforts to write a cost limitation into the measure. "It is perfectly apparent that should the bill become law," said the witness, "the Federal administrator could build up a good claim of the need of a staff of agents, inspectors and investigators that would run into millions of dollars annually. The proponents are designedly minimizing the prospective cost."

Figures from the U. S. Bureau of Mines, he added, "refute the implication that mine safety has been deteriorating and mine fatalities increasing. They give the lie to the charge that mine operators prefer to murder their men rather than to spend money to guard against accidents."

He testified that Secretary of the Interior Ickes more than a year ago, prior to the appearance of the present bill, went on record in his annual report to Congress with a statement that major explosions in coal mines have decreased 90 per cent since 1910 and that the United Mine Workers in an advertisement in Washington newspapers on April 1 of this year, exploiting the accomplishments of their union, had proclaimed that "working conditions have been vastly improved; there is a greater degree of safety in the mines today than ever before."

"To attempt to capitalize on the recent mine disasters at Bartley, W. Va., and Willow Grove, Ohio," declared Mr. Battle, "and under the stress of public emotion and sympathy to seek blind acceptance by Congress of this pretended mine safety measure is to play politics with human misery."

Contending that the proposals contained in the Neely bill exceeded the constitutional

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authority of the Federal Government, Mr. Battle asserted: "By no stretch of the imagination can the internal workings of a coal mine with reference to mine accidents be said to restrain interstate commerce or be intimately related thereto. If such was held to be the case, if Federal authority under the Constitution can be carried to that extreme, then under it there is nothing left to the States and our constitutional system of division of authority between the States and the Federal Government is at an end."

George D. Horning, Jr., counsel for N.C.A., condemned the measure as unconstitutional, stating that the U. S. Supreme Court had not yet found the production of coal to be interstate commerce but a matter under the control of the States.

Pennsylvania's Department of Mines saw no value in the bill, according to J. J. Walsh, Deputy Secretary. He submitted figures to show the State's good record and progress and contended that the Federal Government could do nothing in the way of inspection that would improve conditions. Representative Robert C. Allen of Pennsylvania condemned the measure as unnecessary and tending to concentrate too much power in Washington. Governor James of the Keystone State registered his opposition by telegram.

Whole Movement Threatened

Relating in great detail the good record made in Pennsylvania toward safety and citing the requirements of the law in that State, B. H. Canon, secretary, Western Pennsylvania Coal Operators' Association, gave it as his belief that a division of authority would weaken the whole movement. H. J. Connolly, president, Pennsylvania Coal Co., speaking for the anthracite industry, said the bill was unwarranted, unjustified, unconstitutional, unnecessary, and an invasion of the rights of the States. Citing the record of his industry, he stressed the fact that it needed no outside help.

Julian D. Conover, secretary, American Mining Congress, emphasized the good work of the U. S. Bureau of Mines and urged that its appropriation be increased so that it continue its usefulness, without any additional law. Speaking for the Wyoming Mine Department, J. M. Sampson, State mine inspector, opposed the bill as unnecessary since State laws are adequate.

Governor Holt of West Virginia said the bill would cause an unnecessary extension of Federal authority, adding that division of responsibility would be more productive of confusion than of success in promoting safety. Dual inspection, as provided in the bill, said J. V. Sullivan, secretary, West Virginia Coal Association, would result in duplication, overlapping and confusion, which would tend to increase rather than reduce mine accidents. L. T. Putman, president, Winding Gulf Operators' Association, characterized specific provisions of the bill as flimsy, ridiculous and containing much evil and no good—a "worthless attempt at legislation" far inferior to the mining law of West Virginia.

J. W. Garvey, president, New River Coal Operators' Association, said the bill would not alleviate the injury status of the industry; that the problem should be approached through educational means. Edward Graff, vice-president, New River Co., described the educational program of his company, adding that the States should handle the problem. W. W. Hunter, chairman, New River District Safety Committee, described that body's program in opposing the measure. D. C. Kennedy, executive secretary, Kanawha Coal Operators' Association, expressed the view that a division of the inspection function between the States and the Federal Government would not be good for the industry. H. A. McAllister, executive director, Logan Coal Operators' Association, severely criticized the inspection system proposed, maintaining that the problem should be solved by the individuals involved.

As representative of the Coal Producers' Association of Illinois, W. C. Gill, its president, said the measure would conflict with existing adequate laws, duplicate State services, extend the scope of the Federal Government beyond constitutional limits and prove of no help to the coal-mining industry. James McSherry, director of the Illinois Department of Mines and Minerals, refuted testimony unfavorable to his department given by United Mine Workers proponents of the bill. He said there is no necessity for a Federal coal-mine inspection law so far as his State is concerned, since it has an excellent law enforced by a corps of competent inspectors. He called attention to recent amendments to the State laws, including one providing for quarterly instead of semi-annual inspections, designed to promote safety with greater effectiveness. Eric Geertz, chief engineer, Cardox Corporation, took issue with U.M.W. proponents of the bill, characterizing their testimony as inaccurate and confusing, especially in alleging that Cardox and Airdox methods of breaking down coal are dangerous. A statement from the Illinois Coal Operators' Association expressed strong disapproval of the bill.

"Confusion and passing the buck" would result if the Neely bill were passed, in the opinion of George Strain, director, Department of Industrial Relations of Ohio. Local inspectors, he said, are in better position to enforce regulations than Federal men, who are not familiar with the general situation. Nelson Hovey, assistant director and legal adviser of the Ohio department, was emphatic that there was "no need for S. 2420 as far as Ohio is concerned." Ezra Van Horn, executive vice-president, Ohio Coal Association, speaking for Buckeye operators, censured the measure as beyond the province of the Federal Government, adding that compulsory Federal inspection is not necessary nor would it be helpful.

Ralph P. Ward, director, industrial relations department, Ohio Chamber of Commerce, expressed the belief that not only would the Neely bill serve no useful purpose but it would be harmful to the economic and social welfare of Ohio. He characterized it as another step in the expanding Federal bureaucratic control over the every-day affairs of the American citizen.

Speaking for eastern Kentucky associations, James F. Bryson stated that the operators in that area have invested about $150,000 in safety equipment, are spending about $50,000 annually for safety inspectors and other work of this nature, and that they do not need any more laws. M. G. Youngquist, representing Iowa producers, said that both operators and miners in his State are against the measure.

M. S. Geismer, representing the Alabama Department of Industrial Relations and the Governor, characterized the bill as an invasion of State rights, adding that the duplication of services inherent in the measure would impair the work of the State mining department. A dissenting statement also was forthcoming from the Alabama Mining Institute.

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West Virginia Mining Institute Highlights Administration and Safety at Bluefield

PRICE regulation, education, unemployment compensation, labor relations and safety all received careful consideration at the summer meeting of the West Virginia Coal Mining Institute, Bluefield, W. Va., June 14-15, at which C. W. Connor, general superintendent, American Rolling Mill Co., Nellis, W. Va., presided. In his welcoming address, W. E. E. Koepler, secretary, Pocahontas Operators' Association, declared that the hope of the coal industry lies in research and more research into such materials as chemicals and plastics as well as into such prosaic matters as stoves, which today still embody the same principles as were evidenced in their prototypes 300 years before the destruction of Pompeii. The first type of research, he hoped, would be conducted in the new Mineral Industries Building, West Virginia University; the second project was about to be launched by the stove manufacturers themselves.

After long delay, the Guffey act is about to become effective, asserted T. E. Johnson, vice-president, Hutchinson Coal Co., Fairmont, W. Va. Though for years the coal industry had opposed price regulation, it found that it was "scraping bottom" about the time NRA was instituted, and began to appreciate such stabilizing support. Today, a large majority of operators approve fixed prices. It is a big order to set selling prices for 13,500 coal mines with almost as many variant conditions, but most operators believed it at least should be tried. Trouble with sizes that the market would not move was put forward as one reason for not embarking in the enterprise, but are there not such troubles now?

With a fixed price it will be possible to project a definite profit and make a concrete basis on which to approach one's banker. Stabilization, moreover, will be necessary to cushion the shocks industry will sustain after the misfortunes in Europe. At least, let industry keep an open mind and, when the law expires in April, the coal producers should have learned enough from its operation to make suggestions for revision or annulment, concluded Mr. Johnson.

Walter Crichton, Johnstown Coal & Coke

Co., could not agree that a mere 60 per cent of the cost was fixed. Among the irreducible charges were the labor scale, railroad transportation cost, price for power, fixed prices for materials. Adding them all up, 95 per cent of the cost of coal was fixed for the operator and only 5 per cent remained that could be varied by managerial skill. With such a modest margin, no wonder the owner desired to have some sort of assurance that it would not be swept away by market vagaries. Can the operator afford to dispense with some such help?

Oil at the Atlantic Seaboard last year was $1.05 a barrel, asserted Mr. Crichton; today it is $1.35. If 4½ bbl. of oil is equivalent to a ton of coal, the price of coal could be $1.35 more and still be as competitive as it was when oil was $1.05, yet the prices of coal were set with that figure in mind. Surely, the price of coal now might be set $1 or more higher.

Some Now Fear Exhaustion

Objecting to Mr. Johnson having quoted the statement that the United States reserves would not be exhausted for 3,000 years, Mr. Crichton said that it might be true, but the Southern area was already becoming troubled with fears of exhaustion. The coal resources in places may be gone in a few years and other coal to replace it will have to travel far at high cost for transportation. Mr. Crichton hoped the Guffey act would be enforced, for, if it is a bad law, the best way to destroy it is to make it operative. In ten more years, declared J. T. Wilson, industrialist, Bluefield, the Pocahontas No. 3 seam will be almost gone. No. 2 will last longer, but it is thin and inferior.

Twenty years ago some of the executives of the coal industry seeking men to replace those in the higher supervisory positions, declared M. H. Forrester, division superintendent, Consolidation Coal Co., brought in graduates of technical institutions, preferably engineering, to learn systematically the practical phases of mining, but, because of a decline in corporate income and a lack of a definite training policy, few of these trained management men survived the brief trial. In consequence, mining schools have not been well patronized. West Virginia University School of Mines, for example, had only 29 graduates in the nine years from 1930 to 1938, a high of six in 1932, a low of one in 1937 and an average of little more than three annually, though eight men were graduated in 1939 and nine in 1940 with a demand for the services of many more now made by the industry.

Experience gained in total mechanization of three mines and a partial mechanization of a fourth, with most of the work completed in four months, said Mr. Forrester, shows no loss in production, but maximum efficiency for some time inevitably will fail to be attained, primarily because of lack of trained operating personnel for individual units. Few trackmen can read and follow the specifications of a track layout and comparatively few repairmen or electricians can read and understand a wiring or assembly diagram.

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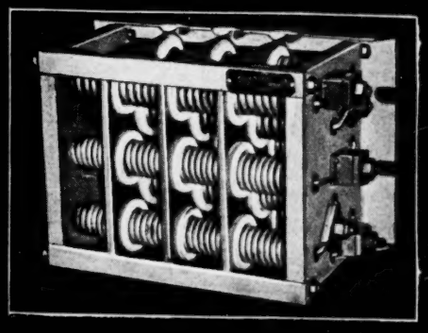

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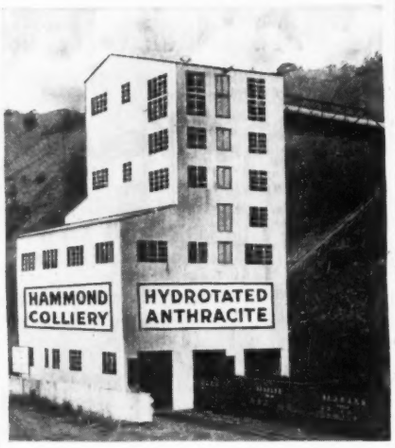

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may render it useless long before its time, increase maintenance cost, lose tonnage and waste labor. Repairmen thus newly introduced to a new piece of equipment cannot keep it in first-class condition, nor adjust it and repair its breakdowns, which they cannot diagnose.

Some form of "in-service" training of the employed personnel obviously is needed. For this, night-school facilities and extension classes are essential. Some supervisory men of the higher brackets may be provided from the limited number who can and will make up their deficiencies by home study, observation and a search for information. Older men who cannot thus adapt themselves must be gradually replaced by younger men, preferably those who have grown up in the coal industry, who combine technical education with a background of practice acquired during summer vacations. A technically trained sales organization also must be created to maintain present markets for coal by the improvement of existing and the development of new burning equipment.

Mining Courses Neglected

These latter men, said Prof. L. I. Cothern, Virginia Polytechnic Institute, an effort is being made to provide by offering a fuel option to mining engineers. In his belief combustion engineers of the coal industry should have a background of mining. School students are not intrigued with coal mining, for they cannot realize the problems that are involved in the operation of mines. The demand at Blacksburg, Va., is mostly for production men rather than for technicians. If only the interest of mining executives in engineering students had been shown four years earlier and they had meanwhile directed their vacational experience and had recommended their electives, there would be more students for their choice.

Much research must be done in the mine, and young graduates might do it as a fifth year of their training. It cannot all be done at the university, though in this also the university can cooperate. New men should have at least a year of practical work before being given charge of a section.

Of 600 questionnaires sent out to junior high schools, not a single reply showed interest in coal mining, recalled J. R. Cameron. Few degree men can be found in charge of machinery in and around mines, and they will not be found there until living conditions are provided equal to those enjoyed by persons of like education working at power houses or at factories. The coal industry needs good mechanical men, more underground than on the surface.

Of 200 high-school students, only one showed an interest in mining engineering, but if the operators show an interest in the students they in turn will show interest in mining, added Prof. Cothern. Young men from the schools around the mines try city jobs for a while, asserted Mr. Connor, but their schooling is not as good as that of the city boys, and they find that the placement bureaus have filled all the jobs with the latter, so, after a year or two's disappointments, they have to return to the mines.

In the steel industry, declared A. B. Parsons, secretary, American Institute of Mining and Metallurgical Engineers, the percentage of graduates has increased from 3 to 25 per cent. Steel corporations are adding only graduates to their sales organizations. In the petroleum industry, all new men at the supervisory jobs in drill rigs will henceforth be technical engineers. True, these are merely routine jobs, but the men will receive good pay and have excellent living quarters. The coal industry should show a like interest in the technical gradute. Formerly, apprentices were everywhere available as budding material for competent technical workers, but somehow in the coal industry they are no more to be found, remarked Veleair Smith, consulting engineer, Charleston,

Describing the fund he is administering, J. S. Stump, Jr., director of unemployment compensation, Charleston, W. Va., said the departments handling these funds were parts of the State governments, though their administrative expenses are paid entirely from grants made by the Federal Social Security Board. None of the contributions paid by employers can be used for any purpose other than the payment of benefits to unemployed persons. To provide for uniformity in the several State laws and to speed their passage it was provided that up to 90 per cent of the 3 per cent Federal Excise tax levied on the payrolls of employers of eight or more employees might be credited to the unemployment trust fund of a State having an unemployment compensation law approved by the F.S.S.B.

To find jobs for the unemployed throughout the country and even abroad (41,370 persons in West Virginia were placed by the employment service in 1939) and to administer the unemployment fund are the two functions of the West Virginia Department of Unemployment Compensation. The coal industry has paid in 35 per cent of the funds collected. In 1938, the coal industry received 69.8 per cent more than it paid in. In 1939, it received 39.6 per cent less than it collected, but demands for millions of dollars because of the wage-scale suspension are pending in the courts.

Present benefit standards in West Virginia can be liberalized and the tax burden can be decreased, for a balance of $16,278,047 was available May 31, though about a million dollars was transferable to the Railway Unemployment Insurance Fund. Benefits in the State may run for fourteen weeks. In most States the limit is sixteen weeks; in some it is longer; some want it extended to 20 or even 24 weeks.

Would Reduce Waiting Time

The minimum weekly benefit in West Virginia is $3. A rise to $5 or even $7.50 has been suggested, without disqualification of those whose annual earnings are less than the amount now required to qualify for a $3 weekly benefit. Maximum benefit is now $15 weekly in West Virginia and an increase is suggested. The suggestion is made that the waiting period, now three weeks, be reduced to one week.

It has been urged that, while the effect of future liberalization of benefits is being appraised, the experience rating contained in the laws of many States, of which West Virginia is one, should be repealed and the present rate of 2.7 per cent continued as a safety rate. Proposals have been presented, on the other hand, to establish effective

experience rating provisions, as well as abandonment of the experience rating principle and a substitution therefor of a flat rate reduction to all industry.

Under the law, each employer is credited with his payments in excess of 1 per cent of his annual payroll for each calendar year. After Jan. 1, 1941, if this credit for all past periods or for 60 consecutive calendar months (whichever is more advantageous to the employer) is less than the total benefits charged against his account, his rate will be 3.6 per cent barring acts of God, fire, other catastrophe or act of civil or military authority, in which case the rate will continue at 2.7 per cent. If the payments exceed the benefits by 10 per cent of the average payroll the rate shall be 0.9 per cent.

Employers Should Do Part

In discussion, Mr. Stump said that in his estimation experience rating was preferable to level rating, for, with level rating, reductions were unlikely. It was highly desirable that employers should contest improper claims and not leave this action to the department. Affidavits of the employer or his agents will not serve, because the accused under the laws must be faced by his accuser. Only by quashing improper claims can experience or level rating and taxes be kept at a low level. That is all very well for big companies, but small ones are not staffed adequately to make trips to Charleston to face the accuser, interposed Mr. Wilson.

Federal and State agencies should get together so that the work of compiling returns may be reduced and reports to one authority may be serviceable in reporting to the other, declared G. C. Pile, auditor, Pond Creek Pocahontas Co., Bartley, W. Va.

Relating a case in which compensation and reinstatement had to be made to men who had never been hired, because when they applied for work they had said they were union men and were supposed not to have been hired for that reason, and another instance in which 42 other men not rehired by a new company when it took over the property of another company were required to be hired and paid from the day their application was rejected, Harry Kennedy, delivering the paper of D. C. Kennedy, secretary, Kanawha Coal Operators' Association, asserted that the National Labor Relations Act was couched in language that may be interpreted only by the administrator, and his word becomes a part of the law unless a costly court action should reverse his opinion.

Safety is costly, but it also pays dividends in more things than money. In production we don't expect something for nothing, so why expect it in safety work, asserted C. J. Flippen, safety director, Norfolk & Western Railway, Fuel Department. Some really good men make mistakes at times, and it is better to help them up than kick them out. Excessive turnover in officials is bad also and, besides costing good money, is bad for morale.

It is not sound economy to give an assistant foreman twice the territory he can supervise well, then ride him when accidents occur from lack of adequate supervision. No foreman should have so much crawling and skidding around that he doesn't have time to think.

Discipline, Mr. Flippen added, perhaps is the most necessary factor in safety but it also can be the most dangerous if not used intelligently, consistently and fairly. In giving it, due notice should be taken of the recipient's station, mental attitude, education, job and length of service with the company and, other things being equal, the same dose being given for the same kinds of infractions.

Every assistant foreman, stated J. J. Sellers, vice-president, Virginia Iron, Coal & Coke Co., has a report book with white, pink and yellow pages, and any violation is entered in triplicate on these. One goes to the general mine foreman, one to the offender, and one remains in the book. The record shows the offense and whether a first, second or third breach of the rules. On it the general mine foreman records the action taken.

When a foreman turns in no violation slips, declared W. J. German, general superintendent, Pocahontas Corporation, his section is checked to see if he is finding and returning all the violations that occur in his section. "The morgue is near my house," he aded, "and when the ambulance rolls up at night, I never fail to hear it, so accident is always in my mind. I pass the morgue every time I go to my office."

As a means of accident prevention, education, said Mr. Forrester, is more important than discipline. Discipline, agreed Mr. Koepler, is negative and depressive and not so good as education. Monthly safety meetings are held at the mines of the American Coal Co. of Allegany County and the Mill Creek Coal & Coke Co., asserted H. F.

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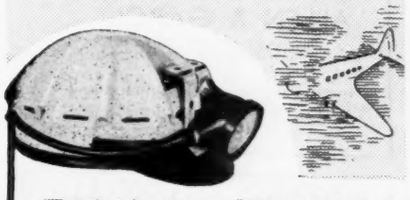

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the consultants whose cards appear on this page with the confidence justified by the offering of these special services nationally.

Warden, general manager, and careful determinations are made as to causes of accidents. Among accident prevention means discussed have been use of measuring tapes without wire threads through which shock might be transmitted and the use of rubber mats on locomotives. One man was electrocuted while nipping in the rain while standing on the bare frame of a locomotive; that nipping is bad practice does not invalidate the need for a mat, added Mr. Warden.

•

Bill for Processing Plants Passes in Illinois

A bill to permit Illinois counties to build and operate coal processing plants was passed by the House at Springfield, Ill., on June 5 and sent to Governor Horner for his signature. It was introduced by Representative Calvin Johnson, of Belleville. The House concurred in Senate amendments which gave the counties the right to acquire and maintain the plants as well as to construct and operate them.

Plans for a processing plant to convert southern Illinois coal into a smokeless fuel have been arranged by the St. Clair County Board of Supervisors, and arrangements for financing its construction are being worked out.

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New W.V.U. Mineral Facilities

West Virginia University's long promised Mineral Industries Building bids fair to become a reality in the near future with the release by the State Board of Public Works of $500,000 for its construction. When erected on the university campus, at Morgantown, the new structure will house the School of Mines, the geology department, the chemical engineering department and the West Virginia Geological Survey. It is planned to get construction under way in the coming autumn.

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John McNeil Succumbs

John McNeil, 87, pioneer Colorado coal man, died June 3 of pneumonia at his home in San Diego, Calif., after a week's illness. Born in Scotland, he came to America in 1876, worked as a miner and mine contractor for a time in Illinois, going to Colorado in 1878 to work for the Colorado Fuel & Iron Co. Later he was employed by the Santa Fe railroad to do coal-mine development work. He was Colorado's first coal-mine inspector and later became a consulting mining engineer. He founded the McNeil Coal Corporation, which developed the Cameo mine, in Mesa County. He retired in 1920 and moved to California.

•

Keck Heads Progressives

William Keck, East St. Louis, Ill., has been elected president of the Progressive Mine Workers, Illinois district, to fill the unexpired term of Dave Reed, Marysville, ousted last January, an official canvass of ballots cast in 95 local unions throughout

the State showed on June 6. The votes were cast in a special election held May 28. The official count was: Keck, 4,661; Joseph Barkoski, 1,402; John Malaker, 1,189.

Mr. Keck will serve only until Feb. 1 unless reelected in the biennial election in December. The special election was made necessary by the removal from office of Mr. Reed and John Battuello, convicted before an organization trial board of conducting negotiations contrary to union rules with the United Mine Workers.

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Trade Literature

BALL BEARINGS—New Departure division General Motors Corporation, Bristol, Conn. Bulletin VIII-15 cites the advantages of mounting self-sealed ball bearings on the eccentric of a small air compressor of the diaphragm type.

BEARINGS—Ahlberg Bearing Co., Chicago. Catalog contains dimensional data on all types of ball bearings, tapered roller bearings, straight roller bearings, thrust bearings and ball-bearing pillow blocks.

BUSBAR SUPPORTS—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Descriptive Data 36-200 describes and lists a complete line of standard indoor bus supports for use on voltages of 600 to 23,000.

COAL CLEANER—National Steel Washeries, Inc., Birmingham, Ala. Bulletin covers the Montgomery Uni-flow coal cleaner, describing its salient features, with sectional and end views, and listing satisfied users.

CRUSHERS—American Pulverizer Co., St. Louis, Mo. Bulletin presents construction features, design and typical installation layouts of rolling ring and swing hammer crushers, grinders and shredders for use on coal, coke and numerous other materials.

DUST CONTROL—Pangborn Corporation, Hagerstown, Md. Bulletin 2056 stresses the importance to industry of controlling the destructive and costly waste of the "Dust Hog."

EARTH-MOVING EQUIPMENT—R. G. LeTourneau, Inc., Peoria, Ill. Bulletin Form G-1031 outlines methods of lowering the cost of overburden removal and materials handling. A study is made of clearing, stripping and handling methods with Carryall Scraper, Rooter, Angledozer and Bulldozer, accompanied by facts, figures and job pictures.

ELECTRIC WELDING PRODUCTS—Air Reduction Sales Co., New York City. Catalog 103 describes the complete line of Airco electrodes and Wilson electric welding machines. It discusses various types of electrodes and offers suggestions as to where each type can be used to best advantage.

ELECTRICAL CONNECTIONS—Burndy Engineering Co., New York City. Electrical connector guide gives a handy method for making a survey of conditions and presents a handy guide for proper selection of connections.

ELECTRICAL EQUIPMENT—General Electric Co., Schenectady, N. Y., has issued the following bulletins: GEA-1607C, on d.c. generators and exciters; GES-2285, on proper voltage control with Type AIRS regulators; GEA-2902B, on vacuum-tube time-delay relay; GEA-3345, synchronous motors and control for part-winding starting; GEA-3352, fractional horsepower sump pump motor.

INDUCTION MOTORS—Reliance Electric & Engineering Co., Cleveland, Ohio. Bulletin 125 gives detailed data on fully inclosed fan-cooled motors, dismantled and cross-sectional views.

INSULATED WIRES AND CABLES—Okonite Co., Passaic, N. J. Bulletin OK-1005 shows by brief text and illustrations how a new insulation or protective sheath is developed, put into production, and checked and tested in laboratory and proving ground.

JACKS—Blackhawk Mfg. Co., Milwaukee, Wis. Catalog 40H describes and illustrates hand- and power-operated hydraulic equipment for a variety of uses.

JAW CRUSHERS—Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bulletin B-6034 covers the four general types of jaw crushers built: namely, fine-reduction, Dodge, Blake and Superior, illustrating and describing each, with sketches showing the principle of operation.

LOADERS AND PILERS—Stephens-Adamson Mfg. Co., Aurora, Ill. Bulletin 240 covers the company's line of units used for loading box cars and piling practically any loose bulk material.

MECHANICAL RUBBER GOODS—B. F. Goodrich Co., Akron, Ohio. Condensed catalog combines engineering data and guide to selection of various products including transmission belting, V-belt drives, etc.

METALLIZING—Metallizing Co. of America, Inc., Chicago. Booklet explains the metallizing process, giving information on the new Mogul Model P unit.

MOTORS AND TRANSFORMERS—Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bulletin B-6033 refers to larger coupled and engine-type synchronous motors, showing various types of construction. Bulletin B-6 96 tells the story of the latest distribution transformers, showing principal design features.

PUMPS—Allis-Chalmers Mfg. Co., Milwaukee, Wis. Leaflet R-6108 deals with the effect of water conditions on the selection of pump materials, presenting factors that affect performance and service.

SAFETY CLOTHING—Industrial Gloves Co., Danville, Ill. Catalog shows timely ideas in gloves, mitts, finger guards, hand pads, sleeves, arm protectors, aprons, leggings, spats and welder's protective equipment.

SAFETY SHOES—Lehigh Safety Shoe Co., Allentown, Pa. Catalog 9 explains safety shoe features and constructions, telling which should be specified for longest wear and maximum foot protection under various industrial conditions.

SCALES—Fairbanks Morse & Co., Chicago. Publication ASB 610-4 tells how accurate weighing is made easy by full-capacity beam for motor-truck scales.

SCREENS—Hendrick Mfg. Co., Carbondale, Pa. Booklet describes flanged lip screens for sizing and dewatering as used for an-

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thracite and bituminous coal, coke and other granular materials. Discussed are short-slot, medium-slot, long-slot, special-slot and overhanging-type lip screens. A table containing complete specifications of available sizes is included in each section.

SELF-LOCKING NUTS—Elastic Stop Nut Corporation, Union, N. J. Folder L40-10 contains concise explanation of the construction and self-locking action of Elastic stop nuts, with graphic listing of the advantages to be obtained through their use.

SHOVEL AND DRAGLINE—Lima Locomotive Works, Inc., Lima, Ohio. Bulletin 121-A stresses a number of striking features of the Type 1201 unit with on-the-job illustrations.

SPADERS—Sullivan Machinery Co., Michigan City, Ind. Bulletin 87-K details features of M-2 spaders and trench diggers for shaft sinking, tunnel and trench work.

STEELS—Joseph T. Ryerson & Son, Inc., Chicago. Catalog lists complete stock of certified steels ready for immediate shipment.

VIBRATING SCREENS—Link-Belt Co., Chicago. Catalog 1762 covers units for effective screening of a wide variety of materials including coal, coke, ore, cinders, sand, gravel, grain, clay, crushed stone, feldspar, etc.

WELDED STEEL BARGES—Dravo Corporation Pittsburgh, Pa. Bulletin 213 describes twenty types of barges, covering both harbor service and river transportation, as well as river towboats, derrick boats, dump scows and ferry flats.

WINCHES — Stephens-Adamson Mfg. Co., Aurora, Ill. Bulletin 340 pictures and describes the company's line of hand and motor winches for lifting and pulling loads up to 3,000 lb.

WOOD PRESERVATION—Wood Preserving Corporation, Pittsburgh, Pa. Form G-11 and Form G-12 are devoted to how to measure the quality of pressure treatment and the economics of wood preservation in underground coal mining.

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Coal-Mine Accident Fatality Rate Shows Marked Decline

Accidents at coal mines of the United States caused the deaths of 53 bituminous and 18 anthracite miners in April last, according to reports furnished the U. S. Bureau of Mines by State mine inspectors. With a production of 32,962,000 net tons, the accident death rate among bituminous miners was 1.61 per million tons, compared with 2.49 in the same month of 1939.

The anthracite fatality rate in April was 4.80, based on an output of 3,747,000 tons, against 4.34 in April, 1939.

For the two industries combined, the accident fatality rate in April last was 1.93, compared with 3.15 in the fourth month a year previous.

Fatalities during April last, by causes and States, as well as comparable rates for the first four months of 1939 and 1940, are shown below:

UNITED STATES COAL-MINE FATALITIES IN APRIL, 1940, BY CAUSES AND STATES

	Underground								Opencut and Surface				
State	Falls of Roof	Falls of Face	Haulage	Explosives	Electricity	Machinery	Other Causes	Total Underground	Railway Cars	Electricity	Other Causes	Total Surface	Grand Total
Alabama	..	..	..	1	..	..	..	1	..	..	..	..	1
Colorado	..	..	..	..	..	1	1	2	..	..	..	..	2
Illinois	1	1	..	..	..	..	..	2	..	..	..	..	2
Kentucky	3	1	1	..	..	..	..	5	..	..	2	2	7
Maryland	1	..	..	..	..	..	..	1	..	..	..	..	1
Michigan	..	1	..	..	..	..	..	1	..	..	..	..	1
Missouri	..	..	1	..	..	..	..	1	..	..	..	..	1
Ohio	2	..	..	..	..	..	..	2	..	..	..	..	2
Pennsylvania (bit.)	11	..	..	..	..	..	..	11	1	1	..	2	13
Tennessee	1	..	1	..	..	..	1	3	..	..	..	..	3
Virginia	1	..	..	..	..	..	..	1	..	..	..	..	1
West Virginia	13	1	4	..	..	1	..	19	..	..	..	..	19
Total (bituminous)	33	4	7	1	...	2	2	49	1	1	2	4	53
Pennsylvania (anthracite)	7	4	3	1	2	..	1	18	..	..	..	..	18
Grand total	40	8	10	2	2	2	3	67	1	1	2	4	71

FATALITIES AND DEATH RATES AT UNITED STATES COAL MINES, BY CAUSES*

January–April, 1939 and 1940

	Bituminous				Anthracite				Total			
	Number Killed		Killed per Million Tons		Number Killed		Killed per Million Tons		Number Killed		Killed per Million Tons	
Cause	1939	1940	1939	1940	1939	1940	1939	1940	1939	1940	1939	1940
Underground:												
Falls of roof and coal	138	174	1.201	1.143	51	34	2.839	2.037	189	208	1.422	1.231
Haulage	47	59	.409	.388	8	18	.445	1.079	55	77	.414	.456
Gas or dust explosions:												
Local	3	1	.026	.006	....	1	.....	.059	3	2	.022	.012
Major	...	167	.....	1.097	....	...	.....	.....	....	167	.....	.989
Explosives	5	9	.043	.059	8	3	.445	.180	13	12	.098	.071
Electricity	14	6	.122	.040	1	3	.055	.180	15	9	.113	.053
Machinery	6	11	.052	.072	....	...	.....	.....	6	11	.045	.065
Shaft	3	1	.026	.006	2	...	.112	.....	5	1	.038	.006
Miscellaneous	4	10	.035	.066	5	2	.278	.120	9	12	.067	.071
Stripping or opencut	3	5	.026	.033	2	2	.112	.120	5	7	.038	.041
Surface	8	14	.070	.092	5	3	.278	.180	13	17	.098	.101
Grand total	231	457	2.010	3.002	82	66	4.564	3.955	313	523	2.353	3.096

*All figures subject to revision.

WHAT'S NEW IN COAL-MINING EQUIPMENT

BEARING WASHER

Simple, fast and economical washing of the large bearings up to 12 in. in diameter used in mine-equipment service is said to be accomplished by the Croft bearing washer, distributed by the Ahlberg Bearing Co., Chicago. In operation, with the container half filled with cleaning fluid, the bearing is placed on the cone, and the gun is employed to force cleaning fluid all through the bearing.

•

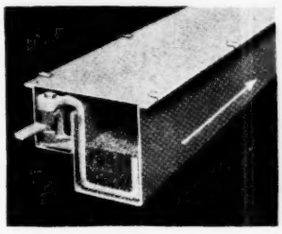
NEW ELECTRIC CAP LAMP

Koehler Mfg. Co., Marlboro, Mass., has perfected a new model Wheat electric cap lamp embodying several features that afford a variety of beam patterns for various kinds of work demanding specialized lighting. A new gas-filled bulb producing a uniformly bright beam with maximum reflector efficiency, says the manufacturer, insures 20 per cent more light than with old models. The headpiece is smaller, lighter and stronger, as well as moistureproof and dustproof. The battery is charged through the headpiece, it not being necessary to disconnect any part of the battery, headpiece or cord to charge the lamp. According to the manufacturer, the battery is small and is equipped with a non-spilling device. Where it enters the battery the cord is protected by a new rubber guard. All parts are so designed and constructed as to provide the greatest comfort for the wearer.

•

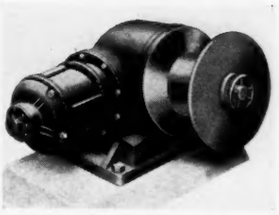
MASS-FLOW CONVEYOR; CAR PULLER

A new-design Redler conveyor announced by the Stephens-Adamson Mfg. Co., Aurora, Ill., features a driving chain moving in a compartment separate from that handling conveyed material. Available in the horizontal closed-circuit type unit, the new design eliminates metal-to-metal contact in the carrying run and prevents possibility of dirt and lubricant contaminating material. The new arrangement does not add to the over-all width or length of the conveyor; the addition in size of the casing is made on the inside of the circuit. This design is available in either the 90- or 180-deg. type, the former having four corners, each curved at 90-deg. angles, and the latter having two curved corners, each 180 deg. The latest design is said to retain such advantages as inclosed and dust-tight con-



struction, compactness, minimizing of breakage of conveyed material, elimination of feeders, minimizing of explosion hazards, self-cleaning action, elimination of pits for elevating units, and ability to handle practically any required tonnage.

The No. 14 wire-rope car puller with horizontal capstan also is offered by Stephens-Adamson. Compactly built, with a capacity up to six fully loaded cars, it is specially designed with heavy-duty clutch and flanged drum. The drum will accommodate 500



ft. of $\frac{5}{8}$-in. rope, the clutch, operated by handwheel, disengaging the drum to pay out rope. One end of the pulling rope is fastened to the drum, which winds and stores surplus rope as cars are pulled forward.

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TRANSFORMERS

Niagara transformers are offered by the Erie Electric Co., Buffalo, N. Y., in sizes from 1 to 2,000 kva. in all standard voltages and frequencies in oil-immersed self-cooled type; also in air-cooled dry type up to 50 kva. Made of high-grade materials, all coils are vacuum impregnated and all tests are made according to A.I.E.E. standards.

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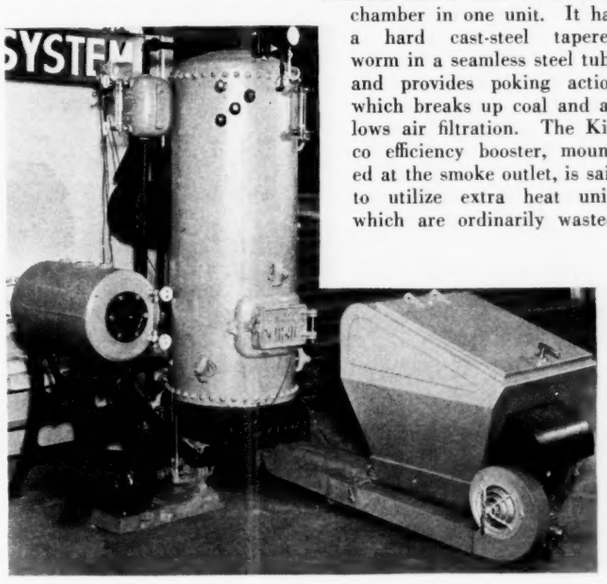
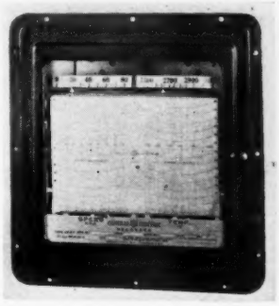
STOKER-FIRED BOILER

Kisco Boiler & Engineering Co., St. Louis, Mo., offers a new stoker-fired boiler embodying a specially designed and constructed stoker and combustion chamber in one unit. It has a hard cast-steel tapered worm in a seamless steel tube and provides poking action which breaks up coal and allows air filtration. The Kisco efficiency booster, mounted at the smoke outlet, is said to utilize extra heat units which are ordinarily wasted.



RECORDER; SWITCHGEAR; ROTOR; CONTROL

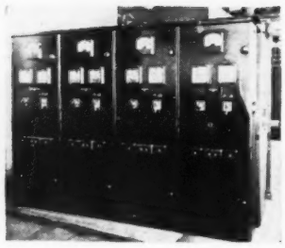
A new duplex recorder for recording simultaneously kilowatts and rkva., or kilowatts and frequency, or volts and amperes, is announced by the General Electric Co., Schenectady, N. Y. It consists essentially of two separate Type CD instruments placed side by side in one case and arranged to record on a single chart. Timed by



a high-torque Telechron motor, or an eight-day spring clock, the chart carriage feeds the paper at 1, 2, or 3 in. per hour. Metal pins on each end of the timing drum, engaging in holes on each side of the record paper, assure a positive drive. Each element, equipped with a conventional pen and inkwell, is calibrated for a 4-in. ruled section of the 10-in.-wide record roll.

Important design improvements on MI-9 metal-clad switchgear also are offered by G. E. All buses and connections are now completely insulated: the main bus is covered with a molten insulation having a dielectric strength greatly in excess of the 5,000-volt rating of the equipment; all bus connections are covered with two-piece molded covers, which are filled with compound. A screw-jack mechanism, which is built into the housing, raises and lowers the breaker. This can be manually or electrically operated. Mechanical interlocks, removable breakers, and isolated current transformers, buses and connections also are retained as features.

Type MI-9 uses a G.E. circuit breaker employing the oil-blast principle of circuit inter-

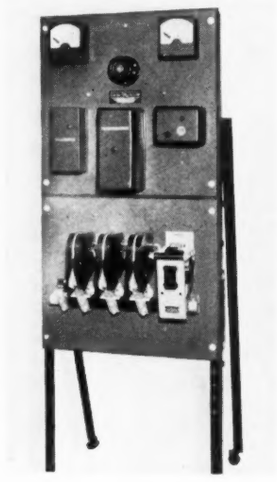


ruption. The primary disconnecting devices are of the stud-and-socket type, with silver-to-silver high-pressure line contacts. Stationary sockets are mounted in glazed wet-process porcelain; movable contacts are the oil-circuit-breaker studs. Secondary disconnecting devices automatically connect or disconnect all the secondary connections when the breaker is raised or lowered in the housing. But making and breaking the circuit always is done by the breaker, for mechanical interlocks prevent disconnecting or reconnecting the breaker while it is closed.

Offering the advantage of long motor life with low maintenance, a new type rotor construction announced by G.E. makes possible the use of cast-aluminum rotors in the larger sizes of double-squirrel-cage motors for high-starting-torque, low-starting-current service. Called the "Valv-amp" rotor, it makes use of an unusual shape of rotor slot and a special method of assembling rotor punchings to control the flow of starting current. As a result, without the use of a switch or other moving parts, current is permitted to flow in the outer squirrel cage when the motor is started, thus producing high-starting torque. Then, when the motor comes up to speed, current is allowed to flow through the entire rotor "winding," resulting in excellent running characteristics.

Of the two conventional methods of double-squirrel-cage-rotor construction—that is, casting the conductor bars and short-circuiting rings integral or joining them by brazing—the former method is said by the manufacturer to be a simpler operation, with smaller chance for human error, and results in a more compact, uniform product. However, until the Valv-amp development, it has not been practicable to cast double-squirrel-cage rotors in the larger sizes. The Valv-amp development, however, allows the construction of larger cast-rotor motors which inherently combine the advantages of the double-squirrel-cage motor, such as high-starting torque, low-starting current, and excellent running characteristics, with advantages of the conventional cast-rotor motor-simplicity of construction, long motor life, little maintenance, and permanence of electrical characteristics.

A new synchronous motor control featuring the slip-cycle impedance SCI relay developed by G.E. permits the device that allows accurate control of synchronizing speed, so that the field cannot be applied until the motor has reached a speed at which it can synchronize its load. This speed is easily set at a trial start by an adjusting screw on the front of the relay. Undesirable current and torque fluctuations are avoided, because field can in no case be applied unless the load can be synchronized.



This control waits until motor reaches the correct speed, and then selects an instant of favorable angular relation of stator and rotor poles to apply field in order to take advantage of the inherent synchronizing ability of the motor. The SCI relay also prevents pulsations in case of motor pull-out by promptly disconnecting the power (or field if automatic resynchronization is desired). Protection of the squirrel-cage winding during starting and the stator winding during running is provided by separate relays which match the widely different characteristics of the two windings. This system of field application is available for control of all ratings of synchronous motors. Magnetic or semi-magnetic forms are available for full-voltage, reduced-voltage, or part-winding starting.

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TRI-STAND VISE

Ridge Tool Co., Elyria, Ohio, has added to its Ridgid line of pipe tools a vise complete with three-legged stand that offers new convenience features. The legs are constructed to give perfect balance when set up and prevent tipping; hinged at the tray, they fold together compactly and fasten with a chain for convenient handling and carrying. Legs are equipped for screwing to plank or floor if desired.

The tray is wide and roomy, providing space for dope pot, oil can and tools. Tools can be hung on the raised rim as well as in slots provided in the tray. There are a pipe rest and three different size pipe benders that won't collapse the pipe; also quickly adjustable screw for ceiling brace to hold vise rigid while in use. Vises are available in 2½-in. yoke and 4-in. chain patterns—made of special strong malleable metal; jaws of high-quality tool steel, scientifically hardened for firm grip and long wear. Yoke vises have No-Mar jaws that protect pipe surfaces.

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WIDE-VISION GOGGLE

A full 150-deg. effective range of vision is offered in the new improved No. 220 wide-vision goggle developed by the Chicago Eye Shield Co., Chicago. Hardened safety lenses provide maximum protection against severe impacts. An important feature is the new one-piece molded cushion pad, composed of a very pliable material highly resistant to perspiration and said to conform to varying contours of practically every wearer, seating each eye cup comfortably and snugly. Additional ventilation holes in the rustproof metal portion of the eye cups increases cool-air circulation. The nose bridge is adjustable to different facial widths. Both lenses are easy to renew by sliding them through the outer side of each eye cup and inserting replacements.

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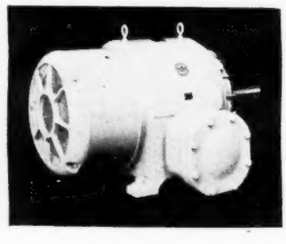
EXPLOSION-PROOF MOTORS IN LARGE SIZES

Higher horsepower explosion-proof motors are now offered by the U. S. Electric Motors, Inc., Los Angeles, Calif., and Brooklyn, N. Y. In Class I, Group D, approved by the National Board of Fire Underwriters, the ratings have been increased from 25 to 75 hp., while in Class II, Group G, they have been increased to 75 hp.



The larger motors are of shell-type frame construction and have a specially designed fan which is said to be quiet even at high speeds. Wiring is made more convenient with a new larger terminal box; for example, the cubic content of a 40-hp. 1,800-r.p.m. unit is 600 in. The fan-end inner end bell and the outer fan cover bracket are held in place with a simplified-type combination screw which eliminates one set of holding screws and supplies rigid and secure mounting for the fan cover and bracket as well as facilitating assembly or disassembly of the motor.

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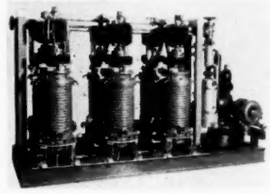
POWER RECTIFIER

A single-anode power rectifier, designated as the Excitron type, is announced by the Allis-Chalmers Mfg. Co., Milwaukee, Wis. Instead of having all the anodes in one vacuum chamber, the Excitron consists of factory-assembled groups of relatively small vacuum tanks each containing a single anode and its individual cathode. The tanks, which are externally cooled by water, are generally mounted in groups of six on a heavy structural steel frame. This frame also supports the vacuum pumping equipment, which is connected to the tanks through a vacuum pipe manifold. The arc ignition and control equipment also is mounted and wired on this frame.

Due to the closer spacing between an anode and its associated cathode than in the multi-anode type of rectifier, the



voltage drop in the mercury arc is reduced, and as a result the company asserts that the efficiency of the Excitron unit is from 3 to 4 per cent higher in the lower voltage brackets. Although this advantage is particularly pronounced at 250-300 volts, this rectifier is said, none the less, to be equally adaptable for use at higher voltages. While possessing all the advantages inherent in the single-anode type of rectifier, the Excitron unit does not depend for its operation on a control tube but is said to make use of sturdy and simple arc ignition and control devices.